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Back to DAY RATES

Eleven months ago the first of the big automobile plants abandoned wage incentives and went back to the day rate method of paying its men. Since then others have followed suit and the rest are considering it. Why? Should companies in other fields take similar action? Who wins under the new plan? Who loses?

CHARLES B. GORDY

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IN 1893, Halsey outlined before the A.S.M.E. a bonus plan based on the assumption that a day's work could not be measured, and that to prevent the rate-cutting evil under the piece-rate plan part of the saving made by the workman was to go to management to pay for job improvement. A little later time study, as a device for measuring output, began to receive attention.

In 1913, conveyors were introduced into automobile manufacturing and by this means operations, where volume sufficed, were arranged in sequence and machinery grouped so that a squad of workmen completed one part, and one part only, day after day. With this sequential flow and worker group interest in the same part, wage plans were devised, either piece rate or bonus, which rewarded the men as a group or collection of workers rather than as individuals. In the early 1920's these plans made rapid progress, till, with the exception of the Ford Motor Company, practically every plant used one or the other of these plans.

Beginning last March the retreat from Moscow began when the first automobile plant returned to the straight hourly method of wage payment. During the summer other plants made the change, including some of the largest units in the industry. At present many companies are on the fence and within the past week one large parts supplier has abandoned group incentives. Group piece rates and group bonus plans are equally vulnerable. Some difference of opinion exists, however, as to the applicability of the day rate to the small output plant, as will be considered more fully later in this article.

The reasons for this revolutionary shift in method are many. In the first place, a considerable sector of management never became fully reconciled to the rather complicated method of calculation and the records involved in the group plans. This lack of management conversion was paralleled by a failure on the part of a great many workers to understand how to figure their wages and why their earnings in one pay period should be less than in a previous one though they felt they worked as hard, or harder. Failure in these respects led to complaints by workers and a feeling that they were not being treated fairly. While such was not necessarily the case, a stoppage of work near the end of a component line would perhaps throw the dammed up work into the next pay period, and management was frequently thrown on the defensive.

Again, while in theory the group in-

centive encourages all workers in the group to perform a normal or standard day's work, yet as a matter of experience it was frequently found, especially if the group was large, that some loafers were tolerated by the men themselves. This served as a drag on group earnings and an increase in cost for the company.

In the group piece plan, since the standard was set in money, there was no opportunity of rewarding individual merit except as it was taken away from other workers in the group in those cases where the merit did not result in a proportionate increase in the output.

These plans have proved especially vulnerable in the last few months. It is easy for anyone with an ulterior motive to exhibit the guaranteed day rate as evidence of an unfair wage policy, even though the earned rate, secured by adding the bonus percentage, might be an entirely satisfactory rate of earnings. When new models are introduced into the shop there are always a host of details which have to be adjusted before production moves smoothly. Workers must learn to do many new jobs, or old jobs in slightly different ways, which means that for the first few weeks efficiency is much below what it will ultimately become when these matters are adjusted. Under the grouping plans this implies either low earnings for the workers or contributions from the management to bring earnings up to what would be considered normal. In the past such matters could properly be adjusted by a progressive change of rates as production and tool supervisors were able to adjust difficulties on the lines, and as workers became familiar with the new tasks. Such changes in rates resulted in normal earnings for the particular occupations in question for that community. Such necessary and normal changes are susceptible of misinterpretation with the result that needless misunderstandings between management and workers may arise. Day rates avoid these troubles.

A greater burden is thrown upon the foremen and supervisors in keeping the men busy by shifts from one job to another in case of production difficulties. Qualities of leadership are required. The foreman must know and evaluate the scrap and output of each of his men, must measure the ambition and capabilities of each, and must shift qualified workers to higher paying jobs lest interest and pleasure in work be dammed up and refused fair opportunities. The calculation of daily efficiencies of each supervisor is an exact measure of how successful he is in the exercise of leadership

The initiative in making the change was taken more frequently by management than by workers, the motive being to get away from plans difficult to understand, requiring constant justification and susceptible of misinterpretation. Frequently works council members presented the possibility of a change to management, not as a demand but as a matter for discussion. In some instances councils were requested by management to vote on the method of payment desired. In one such case workers raised the question whether efficiency could be maintained under the day rate, thus showing appreciation of the problems facing the company in a highly competitive industry. In this same plant the workers pledged themselves that efficiency would be maintained. In the foundry, the worker representative requested the supervision to leave and secured a pledge by a show of hands. It is interesting to note that the efficiency has been maintained in this plant.

The adjustments made necessary by paying by the hour instead of by group incentive are not as difficult as may at first appear. Direct labor costs as well as total car costs must be known and controllable before selling prices are set. For strictly overhead items that involved an estimate of the output; under the group piece rate direct labor costs were constant, as with individual piece rates, while under the group bonus direct labor costs are constant at 100 per cent efficiency and above. Aside from variations in absorption of overhead due to output being different from that estimated, costs could be controlled by watching the per cent efficiency of the various operating groups, assuming a fixed schedule of day rates within each group. In a group of ten men, hourly rates may vary from 60 to 90 cents. The weighted average of this spread at 100 per cent efficiency or above gave constant costs in the bonus scheme. Adjustments in these rates were made at periods of model introductions or at times when costs could be increased with increase in efficiency of the whole group.

The necessity for and the means of obtaining constant costs through checks on operating efficiency still exist under the new plan. The crux of the matter is time measurement through time study, which is, if anything, more important now than before the change. No adjustment of operating sheets was necessary with the bonus plan since the standards were in time and it was only necessary to introduce a new schedule of day rates, one plant employing some 15,000 men making the shift overnight. In the group piece work plan the price for each operation had to be translated back to minutes, an operation that could readily be done on a slide rule.

Job Timing

The mechanics of efficiency calculation is largely the same with the day rate. Each operation and each part has a standard time set up, and unless an engineering change is made the bonus time records are used directly. If such change is made the job is retimed. The clock cards of the men working on the part are totaled and this actual time divided into the standard time gives the efficiency of the group as in the past. In this fashion, efficiency is calculated for each supervisor on each shift. These, in several instances, are combined into a plant efficiency by divisions by ten o'clock the following day.

The control of costs as they are affected by the composition of the group hourly rates is likewise little affected.

Now, as in the past, the time study department sets the number of men of each labor grade required in each group per unit turned out. The management determines the rates for each grade, which affected direct labor costs only under the bonus plan. To keep costs on a controllable basis the weighted average of these groups is maintained by the employment department fixing the rate at which each man is hired into a specific group. A change in rates by the foreman which will disturb the average group rate requires management approval. Should costs be increased through failure to maintain efficiency, competition being what it is, the parts so affected would have to be farmed out to supplying companies with lower costs; a condition desired neither by management nor workers.

Supervision

Under group incentives an advantage stated is that the group is self-regulatory, the earnings varying with amount of work turned out, self interest thus replacing force or drive as a motivating influence. With this factor removed in the day rate a greater burden is thrown upon the foremen and supervisors in keeping the men busy by shifts from one job to another in case of production difficulties of any sort.

Qualities of leadership, in addition to better planning, are required. The foreman must know and evaluate the scrap and output of each of his men, must measure the ambition and capabilities of each, and must shift qualified workers to higher paying jobs lest interest and pleasure in work be dammed up and refused fair opportunities. The calculation of daily efficiencies of each supervisor is an exact measure of how successful he is in the exercise of such leadership.

Although instruction has been given foremen in these matters it has been found that many have not been able to measure up to the new requirements and have had to be replaced.

Apparently no change in the number of men per supervisor has been made by conscious calculation although it is likely that experience will show that the more intensified supervision will gradually result in some reduction.

Control points for counting output and the inspection of it are largely the same.

The change was and is being made when the production curve for the industry is on the up grade and the picture may be somewhat different with a declining rate. At present, however, the experience is that efficiency is being maintained and in some cases an increase is reported.

It may be stated that both parties are benefited in that a frequent cause of misunderstanding is removed. The worker is able to calculate his earnings easily. So many hours worked at a certain rate per hour tells him immediately and he is not confused by per cents of efficiency nor in doubt as to the effect on his earnings of a fellow worker inclined to take things easy, nor inclined to feel cheated by the banks of partially completed work not reported by the inspectors. The very capable and ambitious worker is stimulated by increased contact with the foreman through a realization that individual merit is rewarded by an increase in rate, a shift to a higher paid job, or both.

The necessity for adjustment of rates as jobs are changed, or as the operating department becomes more efficient through practice and familiarity with new work, has been mentioned. With group piece rate incentives this would be considered a cut in rates, justified by the facts in the case, but again management must explain and is at once thrown on the defensive and dangerously so if the foreman is not a capable explainer. Outside forces furthermore could make easy capital out of the move. If, let us say, a customer decides that a lacquered part costing 8 cents can do with just half as much lacquer and that the price can thereby be brought down to 4 cents, the supplier finds that less material is required and half as much labor in spraying. There is now no need to adjust rates. Since half as much labor is required, half the operators formerly needed may be shifted to other work and those remaining instructed to spend half as much time per piece as formerly. This is a limited example of the wide flexibility found to exist in the day rate plan.

Under the incentive plans, if the earned rates were about what they should be over a period, sudden variations from normal costs were frequently not checked into immediately, especially if supervision was inclined to lean rather heavily on the self-regulatory principle of the group plan. With such regulation no longer a motivating force, supervision, including tool, material, cost and operating foremen, are brought more quickly to the task of adjustment, especially through pressure of the foreman on functional departments to get his operating efficiency back to standard. It is the experience that out-of-line costs are more quickly brought back to normal.

Clerical costs in payroll computations are less since per cents of efficiency do not have to be applied to each worker's earnings, as was true under the bonus, nor does the group piece earning have to be divided among members of the group as is true of this type of payment.

Large or Small Output Plants

In plants with large volume output six men will be required to do one job or operation; with a small output one operator may do six operations. In the latter case, his incentive under the day rate is limited to a desire for a higher rate than the one he may be receiving at present. If this ambition is weak or lacking, a routine or habitual output less than normally to be expected is likely to result since the worker is not benefited directly and at once by an increase in the number of parts turned out. In instances of this sort, a personal incentive is considered by some to be to the best interests of management and worker.

Where groups may be kept small due to the character of the work so that each man is familiar with and able to see his fellow group members, where workers included in the same group are properly balanced as to speed and temperament, in work, and where closely administered, complaints are likely to be at a minimum or to be non-existent.

Opinion of operating executives is not, however, unanimous in limiting application of the day rate to volume plant; cases of satisfaction of small volume plants with the change to the day rate were discovered in this survey.

In summary, it may be said that the shift to the day rate resulted from failure on the part of workers to understand calculation of earnings under the incentive plans formerly used with attendant dissatisfaction, from misinterpretation from outside forces, and from lack of confidence in their basic philosophy on the part of management. It has been the experience of those plants which have had a sufficient period of trial with the new conditions that efficiency can be maintained or increased, that costs can be controlled and that flexibility in operation is enhanced. Furthermore, with alert operating supervision, individual merit may be recognized and rewarded.

Helical Gears for the Nash Transmission—III

Parts I and II of this article described the forging and heat-treating processes used for Nash transmission gears and outlined the machining operations on five of the eight driving parts. How the high and second speed clutch, inner and outer, and the reverse idler gear are machined is now told

FOR SELECTING the high and second speeds in the Nash transmission a two-part clutch is used. The outer member slides on an involute spline, cut in the inner member, and engages either the clutch shaft or the second speed gear.

The second and high speed clutch, inner, is machined from the rough forging in a four-spindle New Britain automatic. In this machine the hole is drilled, bored and reamed, and one side of the hub and flange faced. Then the 18-tooth involute internal spline is broached in an Oilgear machine from the machined face.

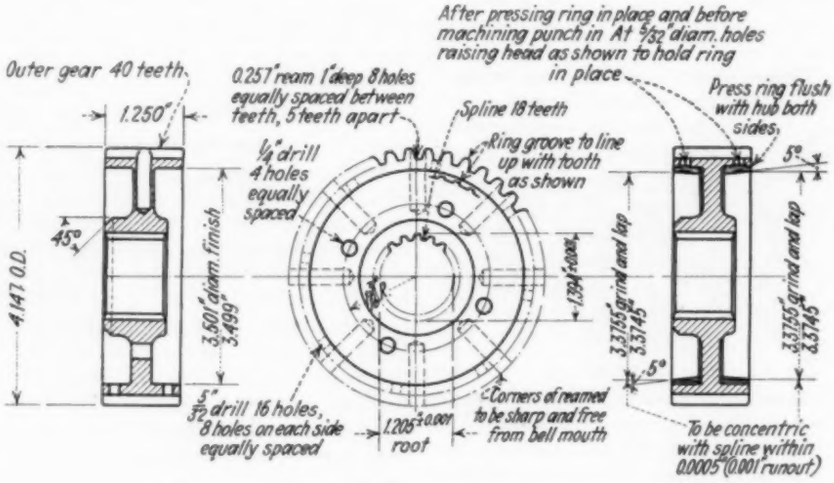
A Bullard Mult-Au-Matic is used to rough and finish turn the part and machine the counterbore on both sides. The six-station machine allows the work to be located twice on a splined arbor, first to turn one side and then the other. In each cycle, one loading and two machining positions are used.

In order to make certain that the spline is free from burrs, it is rebroached with a short push broach in a pneumatic press. This tool has a spherical pilot.

The sides of the part are then faced on an arbor in a LeBlond lathe to maintain better alignment during the gear-cutting operation. The 40 teeth on the outside diameter are finish cut in a Gould & Eberhardt hobber, four pieces at each setting.

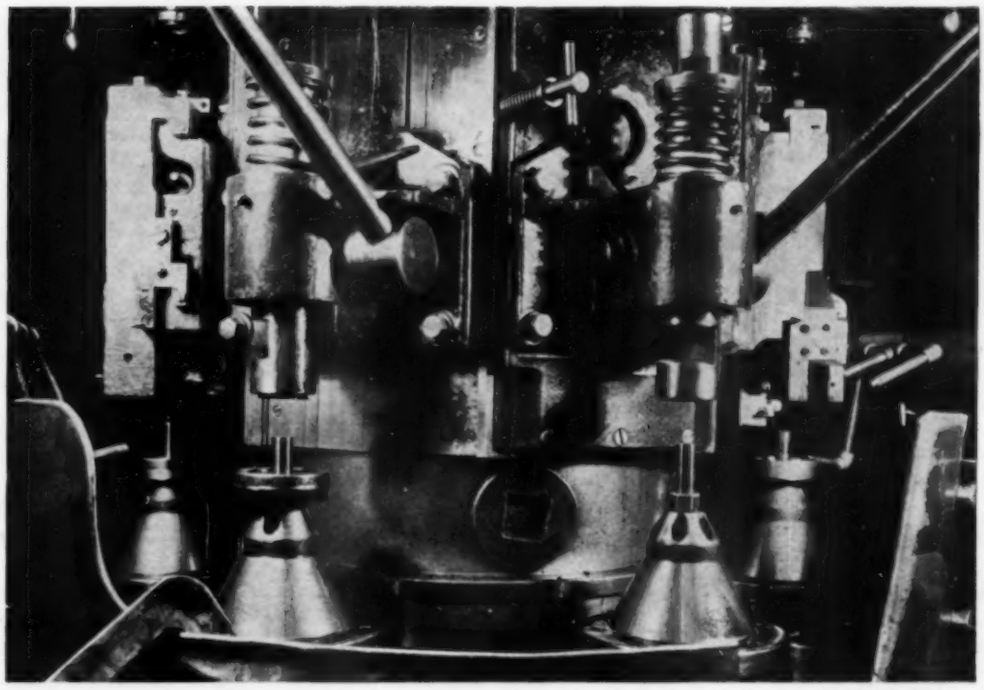
Using a four-spindle Natco machine, eight ¼-in. holes are then drilled in the outside diameter 1 in. deep, four gears at a time, indexing eight times. These holes are reamed to 0.257 in. on a Millholland drill to accommodate ¼-in. balls which act with spring detents in the operation of the clutch.

The sixteen $\frac{5}{32}$-in. holes used for anchoring the synchronizing ring bushings are drilled four holes at once in a two-spindle Leland-Gifford drill, each spindle having a two-spindle head. A Viktor single-spindle machine is used to drill the four ¼-in. holes in the flange which act as oil outlets. Since these holes must not run into the 0.257 in. spring detent holes, a fixture with a


Outer gear 40 teeth
1.250"
4.147 O.D.
45°
3.501" diam. finish
3.499"
0.257" ream 1" deep 8 holes equally spaced between teeth, 5 teeth apart
¼" drill 4 holes equally spaced
Spline 18 teeth
Ring groove to line up with tooth as shown
After pressing ring in place and before machining punch in At 5/32" diam. holes raising head as shown to hold ring in place
Press ring flush with hub both sides
5°
1.394" 1.390"
3.3755" grind and lap 3.3745
5°
3.3755" grind and lap 3.3745
5/32" drill 16 holes, 8 holes on each side equally spaced
1.205" 1.200" root
Corners of reamed to be sharp and free from bell mouth
To be concentric with spline within 0.0005 (0.001 runout)

High and Second Speed Clutch, Inner

Operation	Machine
Drill, bore, ream hole, face hub and flange one side, and face	New Britain 4-spindle automatic
Broach spline	Oilgear broaching machine
Rough and finish turn, face, and counterbore both sides	Bullard Mult-au-Matic
Rebroach spline	Air press
Finish face sides	Le Blond lathe
Cut 40 teeth	Gould & Eberhardt hobber
Drill 8 ¼-in. holes	Natco drill
Ream 8 0.257 in. holes	Milholland drill
Drill 16 $\frac{5}{32}$-in. holes	Leland Gifford 2-spindle drill
Drill and burr 4 ¼-in. holes	Viktor drill
Burnish 40 teeth	Hand mill
Wash, stamp and assemble	
Assemble with clutch, outer	
Harden and temper	
Polish for sclerescope and test	
Anneal inside spline	
Hard broach involute spline	Oilgear broach
Grind I.D. on both sides for clutch ring	No. 72 Heald Sizematic grinder
Wash and inspect	
Press in bronze rings	Flexible press
Seat bronze rings	No. 3 Greenard arbor press
Grind two sides	Norton grinder
Grind taper both sides	No. 72 Heald Sizematic grinder
Run in with mating member	Fellows gear shaper
Wash and inspect	



Load, unload and the first and last turning stations are shown for the inner clutch member

Inner clutch parts are rough and finished turned on a Bullard six-spindle Mult-Au-Matic; the piece at the left is just starting its second cycle

An expansion fixture is used to anchor the bronze rings in the inner clutch which bear against the synchronizing cones

locating pin is employed to establish the correct relation between them.

Heat-treatment of this part follows the standard practice, previously described, except that the two clutch parts are fitted together before hardening in order to minimize distortion. After disassembling, the inside spline of the inner member is tempered to a blue color with a gas torch.

An Oilgear machine then hard broaches this spline to finished dimensions with the work held from four teeth on the outside diameter and square with the face. After giving the parts a 100 per cent test for run-out both inside diameters are ground for the clutch rings, on a No. 72 Heald Sizematic with the work centered from the spline square with face and clamped with a hand-operated pull-back chuck.

A special fixture is used to anchor the bronze rings which

in the operation of the transmission serve to synchronize the shafts when shifting gears. These bushings, which are of the split rolled type, are pressed inside the rim of the clutch chamber. Both the clutch and bushings are located by a pin.

The fixture is mounted on the table of a Greenard arbor press, and with the work in place, a tapered arbor is fed downward by hand. This forces outward eight segments provided with hardened contacts which press the bushing into eight holes previously drilled in the clutch, thus anchoring the bushings securely in place.

Both sides of the rim are ground in a Norton machine with the work held on a splined arbor mounted between centers. The work is again placed in a Heald Sizematic on an expanding arbor in the spline. With a cupped wheel, which spans the hub, the two bushings are finish ground to a 5-deg. taper.

The external spline is then run in with the outer clutch member in a Fellows gear shaper for about two minutes at 550 strokes per minute. Oil is used for this operation.

High and Second Speed Clutch, Outer

The first operation on the outer clutch ring is done in a two-spindle Jones & Lamson lathe. Here the work is bored, grooved and reamed, and both sides faced. The 70-deg. included angle groove is cut with a circular forming tool at the station at which the facing is done to insure accurate location.

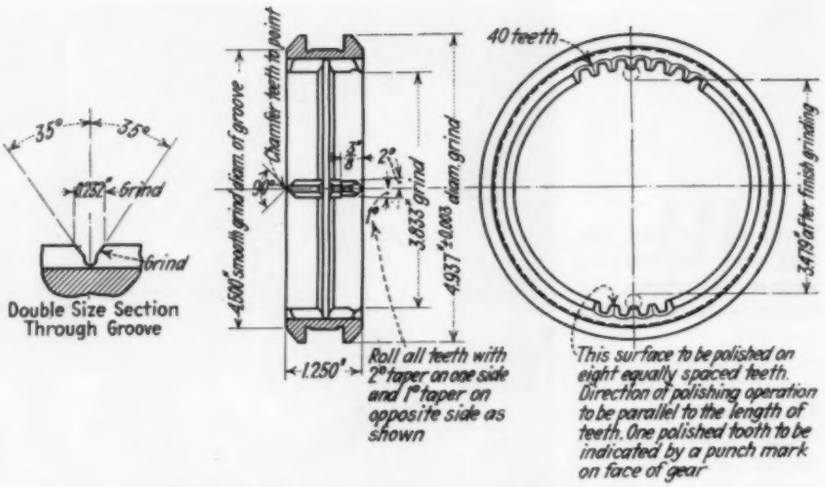
An Oilgear machine broaches the internal spline. For this operation the broaching tool is so heavy that an overhead trolley is used to support it and prevent sagging.

Rough and finish turning the diameter and outside groove is done in a Fay lathe, two pieces at a time. Both front and back tool rests are operated with a scissors-action feed. The parts are mounted on an involute splined arbor. An air clutch holds the work in a Lipe chamfering machine while the ends of the teeth are chamfered. A special hollow mill machines opposite sides of every other tooth at each index.

The second-speed side of the outer clutch has a 4-deg. back taper to match that on the second speed gear; this taper is rolled in on a Milwaukee mill. The clutch ring is mounted on three rollers in a special fixture and rolled in mesh with a hardened master pinion on the machine spindle. The turned outer groove provides sidewise location.

A short combination built-up broach is used to rebroach the work in an Oilgear press. This removes the burrs from tooth rounding and rolling operations.

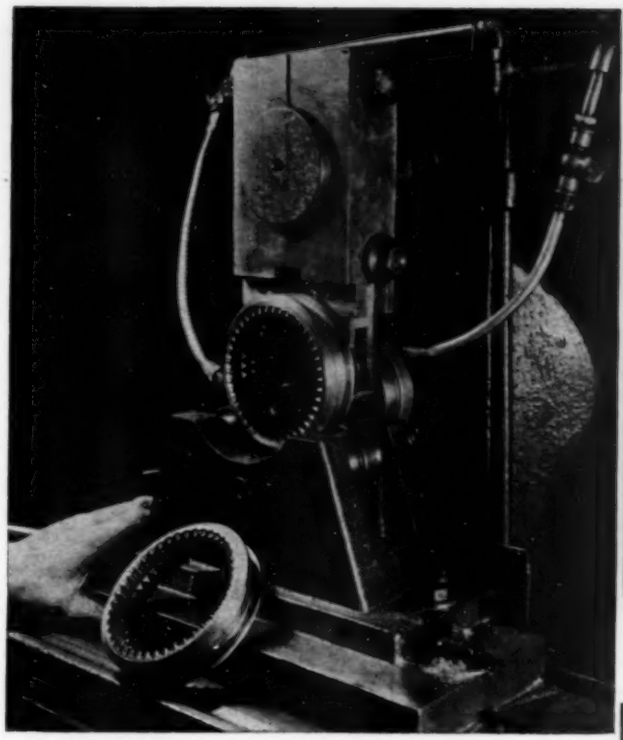
The clutch ring is hardened with the inner member as previously described. The outside diameter and groove are rough ground in a 10x18-in. Norton grinder using a five-tooth expanding fixture to locate the work from its teeth. With the work supported on the ground outside the inside is ground


35°
35°
.125" Grind
Grind
Double Size Section Through Groove
4.500" smooth grind diam. of groove
Chamfer teeth to point
90°
2°
3.833" grind
4.937"+0.003 diam. grind
1.250"
Roll all teeth with 2° taper on one side and 1° taper on opposite side as shown
40 teeth
3.478" after finish grinding
This surface to be polished on eight equally spaced teeth. Direction of polishing operation to be parallel to the length of teeth. One polished tooth to be indicated by a punch mark on face of gear

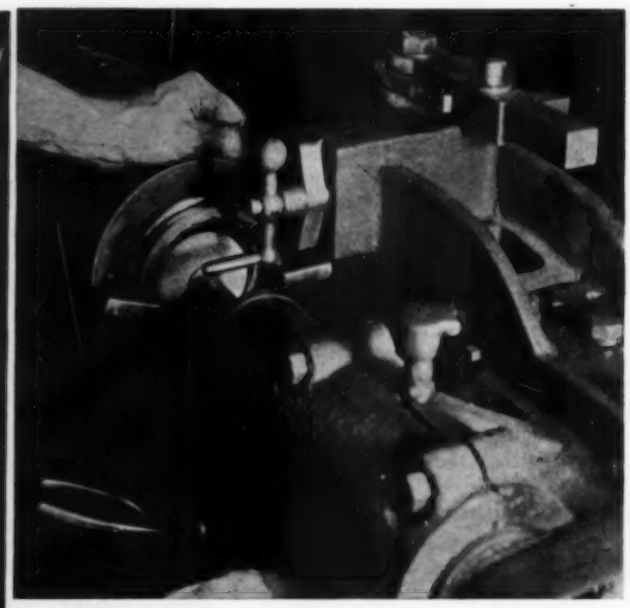
High and Second Speed Clutch, Outer

Operation	Machine
Bore, rough face both sides, groove and ream, turn O.D. part way for broaching	2-spindle Jones & Lamson lathe
Broach	Oilgear broaching machine
Rough and Finish turn and groove, and stamp front	Fay lathe
Chamfer 4f teeth	Lipe chamfering machine
Roll 4-deg. taper	No. 1A Milwaukee mill
Rebroach	Oilgear vertical press
Wash stamp and assemble with inner clutch	
Harden and temper	
Polish for sclerescope and test	
Grind groove and O.D.	10x18 Norton grinder
Grind I.D.	No. 72 Heald Sizematic grinder
Grind V groove	No. 1½ Landis grinder
Finish, grind groove	No. 1½ Landis grinder
Grind ½ in. radial groove	No. 1½ Landis grinder
Chamfer ends of teeth	
Run in with mating member	Fellows shaper
Wash and inspect	

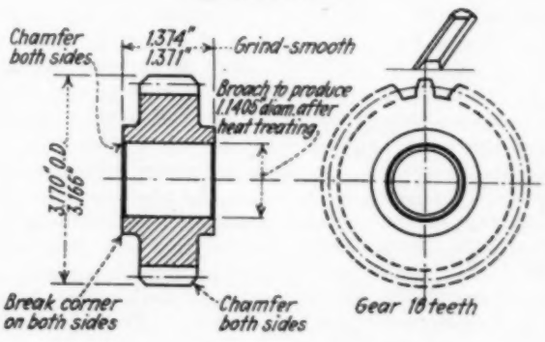
A special cutter rounds both sides of the teeth at once in a Lipe chamfering machine



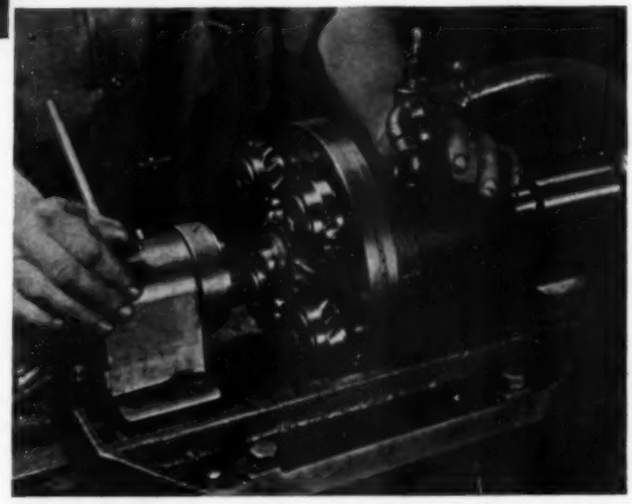
The outer clutch ring is given a 4-deg. back taper by burnishing it between rollers in a Milwaukee mill



With the work supported from the internal teeth, the V groove in the center of the outer clutch ring is finished in a Landis grinder



Reverse Idler Gear



A Garrison chuck holds the idler gear from its pitch line while the bushing is diamond bored

Operation	Machine
Broach bore	Oilgear broaching machine
Rough turn and face	Fay lathe
Finish turn and face	Fay lathe
Chamfer hole both sides	Lathe
Rough cut teeth	Gould & Eberhardt hobber
Finish cut teeth	Fellows gear shaper
Chamfer teeth	Peerless chamfering machine
Wash, burr, and inspect	
Burnish	Fellows gear burnisher
Wash and inspect	
Harden and temper	
Polish for sclerescope and test	
Inspect	
Press in bushing	Air press
Swedge broach bushing	Flexible press
Bore bushing	Le Blond lathe
Grind both sides	No. 20 Heald vertical grinder
Wash	
Lap teeth	Fellows 3-lap recess lapper
Wash and inspect	
Speed test	National Broach speeder

in a No. 72 Heald Sizematic. After the outer groove has been finish ground the internal V-groove is finished in a Landis grinder. An angular diamond truing attachment controls the included angle of the groove during this operation. The angle is important as the balls in the inner clutch engage this groove and govern the pressure required in shifting gears.

The ⅛-in. radius groove at one end of the bore is then ground in a No. 1½ Landis machine. This groove holds the hub in a fixed position when operating in high gear; then the ends of the teeth are chamfered with a conical grinding wheel. After running in

ground with the inner clutch member, this part is ready for washing and inspection.

Reverse Idler Gear

This leaves only one rather simple driving member in the transmission still to be described—the reverse idler gear. The round bore of this piece is first broached from the rough. It is mounted to a fixed position on an arbor, roughed and finish turned in two Fay lathe operations driving through an automatic driver. Both sides of the bore are chamfered.

Seven pieces at a time are mounted in a Gould & Eberhardt hobber for rough cutting the teeth. The finish cutting follows, one part at a time, in a Fellows shaper.

After chamfering in a Peerless machine, the teeth are burred and washed. Then they are burnished in a Fellows burnisher, to make the parts ready for heat-treatment.

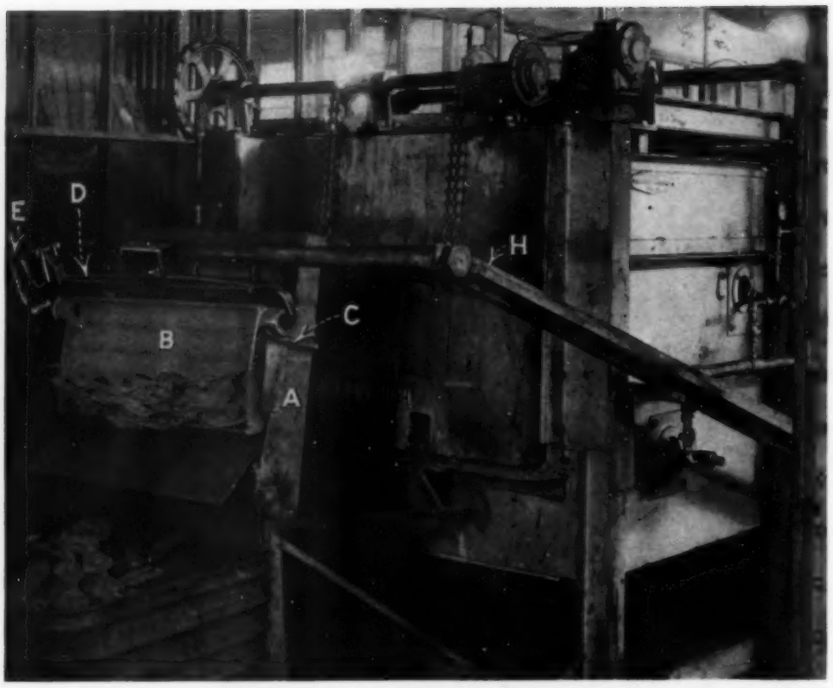
The bushing is pressed into gear and swedge broached to seat bushing securely. Using a Garrison chuck to hold the work true with the pitch diameter of the gear the parts are diamond bored in a LeBlond lathe. Both sides are ground in a No. 20 Heald vertical machine with the work located on a pilot and held down with a magnetic chuck. Lapping follows in a Fellows recess type machine; after washing and inspecting the work is ready for the speed test.

In the foregoing description of the Nash transmission parts, it will be noted that the sequence of operations has been chosen to maintain maximum accuracy in the finished work. In all cases the arbors and fixtures are kept to extremely close limits of accuracy, which is continuously checked by inspection of the work in process. By following these precautions the degree of precision specified by the Nash engineering department is fully maintained.

Handling Heat-Treated Work

Heat treating receives careful attention at the New Castle, Ind., plant of the Chrysler Corporation, and much ingenuity is displayed in making it easy to handle the forgings, both hot and cold, as they go through the different furnaces. One such device has been added to the Holcroft furnace as shown.

The support *A* is hinged at the front end and receives the tray *B* as it leaves the furnace. The stop *C* holds the tray by its ears when the support is tipped up for dumping, as shown.



Arm *H* swings the emptied work tray from the discharge side to the loading side for re-use

Clamp *D*, which has a plug or bolt at the left operated by handle *E*, is hooked into the holes in the tray, as shown. The clamp and tray are then swung up over the furnace to the other end, by the arm *H* and its projection that engages the clamp. When the arm *H* has carried the tray to the entering end of the furnace, the clamp is released, the tray filled with fresh forgings and again started through the heat treat. The arm and clamp are then returned to the discharge end, the support *A* is lowered to receive the next tray and the operation is repeated. The support is held in position by braces that are welded to the furnace, another example of the usefulness of flame or arc welding in every day practice.

Special Apprentices Discussion

HARRY SWANSON

An apprenticeship as outlined by H. W. Dunbar (*AM*—Vol. 78, page 725) seems to be an ideal way of solving the problems of the shop with which he is connected. But what about the thousands of small plants throughout the country? Apparently their best bet would be to pick their boys from trade schools to be operated by the employers as cooperative enterprises. This would provide a much broader field of education, since many different kinds of industry would be represented. Supervisors and instructors could be employed who really understood the art of teaching.

After all, a foreman seldom makes a good teacher. As a rule he is too interested in getting the work done to think about educating his boys. He is much more likely to put the less skilled boys on unimportant work where he does not have to worry about them. Tests of different kinds should be applied to determine the fitness of each applicant for the particular trade he wants to take up. This would eliminate most of the heart-breaking failures that are encountered in so many shops today.

With the present day's use of fine tools and instruments, the boy should first be instructed in the use and care of small tools. For one reason, it is easier for him to grasp the idea of small objects at the beginning. For another reason, the small tools play a large part in his success on large machine tools later on. Slow-motion moving pictures showing a class of boys how a machine tool operator goes about the different set-ups and his movements in operating the machine should help a lot, since an instructor may be inclined to talk a bit too fast to create a lasting impression on the boys' minds.

Machine Exports to Soviet Russia

An understanding of Russian policies and the structure of Russian industries may give an insight into the loss of machine trade with that country and some practical steps for its restoration

SERGIUS D. BROOTZKOOS
Consulting Engineer

PROTRACTED negotiations between the American government and Russia over inter-governmental debts have reached a stalemate with the rejection of the latest Russian proposal by Secretary Hull, or the rejection of the latest American proposal by the Soviets—depending on which way you look at it. The result of this diplomatic failure will be a sharp reduction in what looked like a very substantial market for American goods. But the need of Russia for American products and the eagerness of American manufacturers for Russian orders will combine to find means of financing at least a portion of the potential business. Of this portion the most important part will be machinery and tools and other products of the durable goods industries.

All Russian factories, plants, canneries, railroads, telegraphs, telephones, radio stations, theaters, newspapers, and practically all of the mercantile establishments are owned, controlled and managed by the government. The government runs them in accordance with a prearranged plan, generally laid out five years ahead. This plan is prepared by a special government planning commission, called Gosplan, in accordance with the precalculated and predetermined needs of the population and with the requirements for development, as well as for defense of the country. Thereupon, this plan is discussed, amended and approved by the ruling party at its convention, after which it becomes a guide for the official government in its work.

Setting a Goal

The Five-Year Plan states the goal which the country is to reach at the end of that period. Each year the planning commission prepares for the coming year a plan based on the accomplishments of the preceding year and on the requirements of the Five-Year Plan. This yearly plan must be aproved by the All Soviet Union Executive Committee (the Russian Congress), and then the necessary appropriations are granted to the government for carrying it out.

Output Specified

Under this system of planned economy, the output of each existing plant is strictly specified, and the opening of new plants is scheduled. While the plans are being made, the planning and designing boards for the new plants and the managements of the existing plants present their requisitions for machines and supplies necessary for the fulfillment of the assigned tasks. After their requests are approved by local and district government boards in charge of the particular industry, they finally reach the central government offices in Moscow. Here these requests receive their last scrutiny; if they are approved and the necessary machines are not available in Russia, then they become requisitions to the executive offices of the government to buy them abroad.

Selection of the country where the new equipment will be bought depends upon several factors: price, quality, credit and the general state of trade between Soviet Russia and the country under consideration. Credit is a factor of importance as it may be, and usually is, many months between the placing of an order abroad and its productive operation in Russia. In order to make all possible progress it is desirable in most cases to spread payment over a period of time so the investment will not be tied up for so long without return.

Soviet Russia also makes it a policy to buy from its customers, and embargoes or other trade restrictions affecting Russian exports naturally have an influence in the placing of orders.

The selection of machines and equipments are made by the designing and planning boards for the proposed plants and by the managers and chief engineers of the existing plants.

American Handicaps

In this respect the American machine builders are at a disadvantage compared to their European competitors. The industries in Imperial Russia were in the hands of French, Belgian, German and English capital, and the necessary machines were imported from these countries. The engineers, foremen and workingmen are consequently better acquainted with the European machines and are trained in their use. Furthermore, Imperial Russia had about a dozen technical colleges, where the training was based largely on European data, standards and examples. Many Russian young men, unable to get into the Russian colleges, went for their education to Germany, France and Switzerland and thus became more versed in the machines of our European competitors. In addition, any information, catalogs or even quotations may be secured in Moscow from any European manufacturer within a week's time.

To offset this, many Russians became acquainted and favorably impressed with American built equipment during the operation of the first Five-Year Plan, particularly during the years 1929 and 1930 when Soviet Russia purchased many millions of dollars

worth of American tools. However, non-recognition and a protracted boycott of certain Russian products caused the United States' share in Soviet foreign purchases to fall from 25 per cent in 1930 to 5 per cent in 1933.

After the money is allocated and the selection of the machines has been approved, the requisition for buying is transferred to the government Commissariat for Foreign Trade which is in charge of the whole export and import trade of Soviet Russia. This department has its official trade representatives in all countries where the Soviet government is recognized. In those countries where the Soviet Government is not recognized, local trade corporations are organized in accordance with the laws of the respective country. Thus the Amtorg Trading Corporation was formed in the United States in or about 1924 for conducting trade between this country and Soviet Russia.

As far as buying new machines is concerned, the role played by the Russian government trade representative is to a great extent analogous to that of a purchasing agent in any large American industrial organization. Just as an American purchasing agent buys goods in accordance with the specifications he gets from the engineering and production departments, so the Russian trade representatives buy in accordance with requisitions they receive from Russia.

Changes Are Difficult

Whereas an American purchasing agent may easily get permission to change the specifications and make of the machines, such a permission in the case of Russian trade representatives involves prolonged correspondence, because all important changes must be aproved by the board or the plant which requested the necessary equipment. To prevent such delays the Russian requisitions often include alternative equipments, thus allowing some leeway to the Russian government trade representatives to buy on the best terms and at the lowest prices. Any unauthorized change in specifications or make of the requested machine involves the responsibility of the Russian official who makes it. In exceptional cases only, when the exact trade name of the machine is not specified in the requisition, the local Russian trade representative receives full authority to select and to buy the necessary machines.

In starting new plants, the Russian government usually sends out and attaches to the offices of the local trade representatives special commissions, such as have been sent here recently by the Stalingrad, Kharkov, Red Putilovetz and Cheliabinsk tractor plants; Dniepr Steel Works; Aluminum Plant, etc. These commissions make a complete survey of available sources of supply and make recommendations.

The problem confronting the American machine builders in introducing their machines in Russia is, how to reach the Russian planning, designing, managing and building boards, plant managers, chief engineers and other proper authorities to acquaint them with American machines and methods and to induce them to specify American machines in their requisitions.

Since all Russian industries are owned and managed by the government, the methods of the approach for introduction of American machines are rather unique. For running the industrial and economical life of the country, the Russian government includes in its structure the following industrial departments, called in Russia, commissariats:

Commissariat of Heavy Industries;
Commissariat of Light Industries;
Commissariat of Timber and Wood Industries;
Commissariat of Food Industries.

In addition to the above departments, the following non-industrial departments are prospective users of American machines: Commissariat of Agriculture; Commissariat of State Farms; Commissariat of Railways; Commissariat of Waterways; Commissariat of Post, Telegraph, Telephone and Radio and the Commissariat of Defense (war and navy).

Each department has several main divisions, called "Glavk's," in charge of a particular branch of industry. For example, the Commissariat of Heavy Industries, the most interesting to the American machine builders, has the following main divisions:

Main Divisions of the Commissariat of Heavy Industries

1. Aluminum smelting and manufacturing industry (GLAVALUMINII);
2. Agricultural machinery building industry (GLAVSELMASH);
3. Auto-tractor industry (GUTAP);
4. Aviation industry (GUAP);
5. Building trades and materials industry (GLAVSTROIPROM);
6. Chemical (inorganic) industry (GLAVKHIMPROM);
7. Chemical (organic) industry (GLAVORGKHIMPROM);
8. Coal mining industry (GLAVUGOL);
9. Electrical machines and instruments of low voltage manufacturing industry (GLAV ESPROM);
10. Gas and artificial fuels industry (GLAVGAS);
11. Geological-Hydro-Geodesical Survey;
12. Gold and platinum mining industry (GLAVZOLOTO);
13. Hardware industry (GLAVMETIZ);
14. Machine building industry for serving light industry (GLAVLEGMASH);
15. Machine building industry for mining and fuel industries (GLAVGORMASH);
16. Machine building industry of general medium size machines (GLAVSREDMASH);
17. Machine-tools and small tools industry (GLAVSTANKOINSTRUMENT); with subdivisions: Machine tools and small tools; grinding tools and crucibles; special tool steels;
18. Metallurgical (iron and steel) industry (GUMP);
19. Nickel and tin mining industry (GLAVNIKELOLOVO);
20. Non-ferrous metals mining industry (GLAVZVETMET);
21. Non-ferrous metals manufacturing industry (GLAVZVETMETOBRABOTKA);
22. Non-metals mining industry (GLAVNEMET);
23. Peat industry (GLAVTORF);
24. Petroleum industry (GLAVNEFT);
25. Power generating machinery industry (GLAVENERGOPROM) with the following subdivisions: Steam power machinery plants; electrical machines and supplies of high voltage; storage batteries;
26. Power generating stations (GLAVENERGO);
27. Power plant accessories industry (GLAVARMALIT);
28. Precision machinery industry (GLAVTOCHMASH) with following subdivisions: Testing and measuring machines; optical machines and instruments; sewing machines; typewriters and calculating machines, etc. plants;
29. Rare elements mining industry (GLAVREDMET);
30. Rubber industry (GLAVREZINA);
31. Shipbuilding industry for river transportation (GLAVRECHPROM);
32. Shipbuilding industry for sea transportation (GLAVMORPROM);
33. Steel construction and bridge building industry (STALMOST);
34. Transportation machinery building industry (GLAVTRANSMASH), and divisions in charge of ammunition and armaments industries.

Each above division consists of several subordinate but autonomous offices, bureaus and institutes handling different phases of the activities in its industry. The description hereunder of the organization of the Auto-Tractor Division will explain the scope of the activities of other similarly organized divisions. The Auto-Tractor Division consists of:

1. Main and district offices with their financial, accounting and purchasing bureaus and the following subordinate, but autonomous offices and institutions;
2. Scientific research institute for the automobile and tractor industries with an experimental plant attached to it;
3. Institute for designing and planning new automobile and tractor plants;
4. Distribution office for the disposal of the automobiles and tractors;
5. Managing office of the plants for manufacturing spare parts for automobiles and tractors;
6. Distribution office for spare parts for automobiles and tractors;
7. Independent automobile and tractor plants of national importance;
8. Independent automobile and tractor accessories plants of national importance.

It is, therefore important that the latest catalogs and bulletins on new machines are supplied, first to the New York office of the official Russian government trade representative and then mailed to the following government institutions in Soviet Russia in each particular industry: the central buying office of the industry in the Commissariat of Foreign Trade; the main division or subdivision with their district offices; the research, planning and designing institutes; the main and district supply offices and to the independent plants of national importance. In addition, it is advisable to send out all printed matter to the central catalog libraries and technical information bureaus, organized by the Russian government in all important industrial centers and to the libraries of technical colleges.

Such a circularization program renders unnecessary the mailing of expensive catalogs to individuals who have no right nor authority to select or order American machines. Abbreviated catalogs or pamphlets would serve the purpose when answering such requests from individuals in Russia.

Since the majority of prospective users of American catalogs do not understand the English language, it is desirable to mail American catalogs with Russian inserts. The mailing of an American catalog would prove to the Russians that the machines shown therein are being used by the American industries and are not built for export only, as was their bitter experience with the Russian catalogs of the central European manufacturers. Furthermore, American catalogs are printed attractively and have an exceptional sales appeal. The reprinting of these catalogs in the same manner in Russian would be too costly whereas the cost of a Russian insert, or supplementary booklet, which serves its purpose, printed or reproduced by a photo-offset process would be negligible.

The Russian inserts or booklets must describe briefly and precisely, page by page, the machines shown in the American catalog. Each description of a machine must include an explanation of its action, its range, its productive capacity, its consumption of power, the air and floor space occupied and such other data as are necessary for making plant layouts and for calculating output and return on the investment.

Mere translations of the American catalogs, which often do not include the above mentioned points, are useless from the sales promotion point of view. The qualities of machines generally mentioned in American catalogs as "brass bushed bearings," "hand scraped ways," "automatic lubrication," do not interest the Russians who expect them in American machines of the first class type they usually select. Furthermore, the text of these inserts aside from being grammatically correct must be technically correct. It must be written by a technically educated person versed in the subject and must not be left to translation bureaus, which, as a rule, shop out these translations quite promiscuously.

Technical Data Sought

In this connection it must be mentioned that Russians are now simply avaricious for technical data and information. The articles in American technical magazines are generally abstracted and often translated. Any description of a new machine in these magazines results in many requests to the manufacturer for more detailed information. For satisfying this demand for technical information on American machines and methods, the Russian trade representatives are issuing here a technical magazine in Russian and circularize it in Russia.

Regarding the sending of a representative in to Soviet Russia, it must be borne in mind that he cannot effect any direct sale. All buying abroad according to the Russian laws is permitted only through the duly accredited trade delegations or representatives of the Russian government in the particular country. The role of the American sales representative in Russia would consist of technical propaganda for the machines of his company. He should be a technical man, who can theoretically and practically explain the mechanics, the capacity and the average productivity of the equipments he is recommending. He must be able to solve on the spot the production problems presented to him by Russian engineers, to make sketches of jigs, fixtures and dies. His educational efforts result usually in a considerable increase in orders, provided that the methods recommended by him impress the Russians. The sending to Russia of a "high pressure" salesman without solid theoretical and practical technical background is a sheer waste of money.

In conclusion a word must be said about pulls, personal influence, inside information and other shady dealings in connection with Russian business by the go-betweens, who infested it in the days of Imperial Russia.

The thorough technical and economical examination of each requisition for an imported machine by a half dozen government organizations, independent from that which makes it, renders the claims for personal influence quite valueless. In addition, the separation of the buying activity from the party requesting the machines and the limitation of the buying organization to the ordering of certain makes of machines exclude all personal preference. The people, who at the present time still assert their influence and connections for securing Russian business, are only trying to take advantage of the inexperience of the manufactureers they approach.

Hollow-Head Wood Screws

Years ago some bright individual invented hollow-head setscrews and capscrews soon followed suit. These now adorn many machine tools and fixtures, being much more attractive and convenient than either counterbored filister head screws or projecting cap screws. Now hollow head wood screws are being put on the market by a well known company. No more broken screw heads, no screwdriver slipping out of the slot to jam fingers or work, and the screwdriver holds them in place while driving.

Lock Corner Cans

R. C. GIFFORD
Industrial Engineer

WHERE CANS or covers, made of light metal, are required in large quantities, that is to say millions per year, and where they are not required to be absolutely air tight, lock corners are generally used. This method requires expensive machinery, and consequently its use is prohibited where the quantity required is small. The usual methods, in the case of small quantities, are either drawing, starting with a flat disk and using many operations, a costly procedure, or forming the two sides and bottom of the can in the punch press. The other two sides are also blanked in the punch press, and then spot welded or soldered in place by hand, completing the can.

If the quantity required per year is ten or fifteen thousand, the method described below may be used with economy. This method consists of one blanking and one forming operation. To the best of my knowledge, it was developed in England and is being used by but one manufacturer in this country.

The blank is a cross as shown in Fig. 1 at *B*, the four edges of one side of the cross being bent outward slightly as at *D*, starting ⅛ in. from the edge. This is the start of the inside curl which locks the corner. The shape of the blank and its size must be developed for the paricular can required.

The blank is placed on the die, shown in Fig. 1, curled side down, and one stroke of the press drives it through the die, locking the corners and forming the complete can, as shown at *C*. The blank may be developed so that no triming is required.

Each corner of the die is recessed as at *A*, so that, as the blank is pushed through, first the rectangular bottom is formed and the sides pushed up as at *E* in Fig. 2. Note that the lower corners are now flat while the curled side has been pushed in about $\frac{1}{32}$ in. beyond the edges of the flat sides. At this point the blank has been pushed into the die about 5/16 in.

As the blank moves further through the die, about ¾ in. the corners have started to roll over and are about to fold under the curled part *G* which has been formed at right angles to the side.

At *H* the can has moved approximately 2 in. through the die, the bottom part extending below the bottom of the die. The edge *G* has rolled under the edge *F*, and the two edges have been flattened out flush with the side of the can. The corner roll is clearly shown at *H*, *J* and *K*. At the right is shown the completed can.

In Fig. 3, *N*, *O*, *P*, *Q* and *R* are cross sections of one forming corner of the die. Referring to the views of the partially completed can, these sections would represent the forming points at *E*, *F*, *J*, *K* and *L*. The four corners of the die are alike.

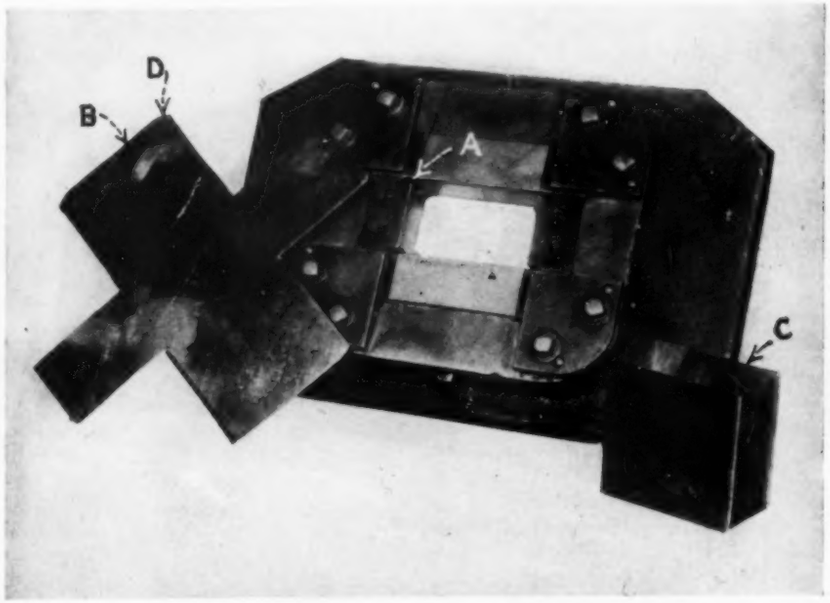


Fig. 1—Blank, die and finished can are shown for making lock corners when quantity is above 10,000 cans per yr.

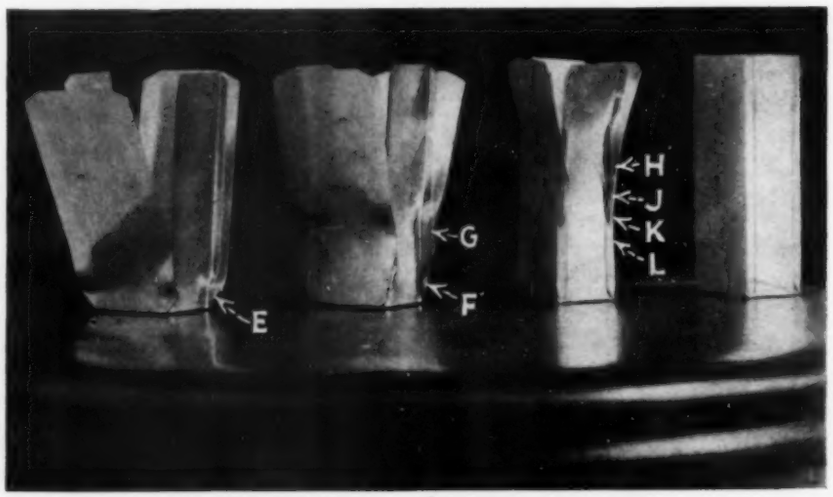


Fig. 2—Evolution of the lock corners is clearly disclosed by partially completed can blanks

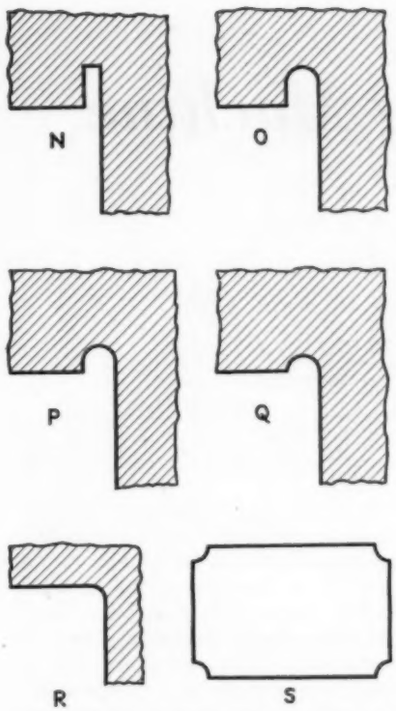


Fig. 3—Cross-sections of forming die corners are shown at *N* to *R* and the recessed punch at *S*

In this particular can, it was desirable to have the folded corners flush with the outside of the can, the excess metal being on the inside. To accomplish this, the punch is recessed at the corners as shown at *S*, Fig. 3.

The shape of the corners may be varied to any form desired. In the can shown in Fig. 1, the excess metal is on the outside, and instead of being flattened, is rounded to a $\frac{1}{8}$ in. radius. The inside of the can is entirely clear.

If an air-tight can is required, the corners may be soldered.

In determining the economy of this method of making cans, as compared with the method at present in use, a careful comparison should be made of the raw material cost in the two cases. The shape of the blank, a maltese cross, leaves much waste material. In some cases, the loss in material offsets the labor saving. The forming output of the tool shown is 1,800 per hour.

Fundamental Facts

FRANK C. HUDSON

Warner Seeley touches a tender spot in my anatomy in his excellent article (*AM*—Vol. 78, page 880) on turret lathes. In two places under the heading of "What the Operator Should Know" he mentioned "fundamental facts," first advocating that a half hour be devoted to explaining them, and second, stating that they can be universally applied. Lack of an understanding of the fundamental facts about the machines being used, is I believe, largely responsible for much of the failure to produce good work rapidly, and also for damage to machines, and for spoiled work.

Fundamental facts concerning machines in general, and the machine to be operated in particular, are vital in the proper training of apprentices or operators. These fundamentals are frequently taught in good trade schools and less often in shop apprentice courses. We will do well to heed Mr. Seeley's suggestions in all kinds of trade training.

Some Hints From an Old Timer

CHARLES WESLOW

In a hand hack saw, I prefer one with an ordinary thumb nut for tightening up the blade. I always arrange the nut horizontal, so that my left hand has a comfortable place to rest while I saw merrily along.

Not as an advertisement, but as a matter of fact, I have used the same Disston 9-in. saw blade ever since I put it in the frame last March. I guarantee that this saw has cut through one square foot of machine and tool steel all told, and some cast iron. It is of medium number of teeth to the inch.

I find it is best for any tool or die maker to have two saw frames ready for use; one containing a saw generally used on drill rod or machine steel or cold rolled, over $\frac{1}{2}$ in. in diameter, or perhaps over $\frac{3}{8}$ in. in diameter. In the other frame I keep a saw with finer teeth, that I use on rods under $\frac{3}{8}$ in. When only three or four teeth contact the material while sawing, one of those few teeth is likely to break out, due to the excess size chip each of those teeth pushes out. However, when I have occasion to saw off from a rod $\frac{1}{8}$ in. or less in diameter, I use a 6-in. instrument maker's saw, which has about three times the number of teeth to the inch as a fine tooth 9-in. blade. Thus I have three different saws and frames for cutting off pieces in the vise.

When toolmakers of my own caliber are given the job of sharpening small piercing punches in the punch holder, we hold the punches together with small clamps with pieces of stock inserted between the punches, so as to prevent the emery wheel from breaking any of them. If the punches have been used, we place a pierced blank over all the punches, which holds them all together securely, and eliminates any risk of punches breaking during the process of sharpening.

Before using a surface grinder for any purpose whatever, I always make certain that the wheel I use is of the proper grade, and either hard or soft, and never start to grind unless I first dress the wheel with my diamond. I never dress the wheel, without first covering the magnetic chuck with a sheet of paper, so as to prevent the chance of emery particles getting into the surface of the chuck. A good toolroom foreman appreciates such carefulness.

I never lay work to be ground directly on the face of the chuck. I always sandwich a sheet of paper between, and then I know the work will come off easier when I reverse the switch. Such carefulness also preserves the face of the chuck. Every time a piece of work, especially cast iron, is slid on and off the magnetic chuck, the face of the chuck becomes that much more worn, and that generally happens around the center.

Which Weather Depressions Best—Special Machines or Standard Lines? Discussion

A. W. FORBES
Forbes & Myers

Herbert F. Crawford asks this question (*AM*—Vol. 78, page 644). The only way to answer it is to get the actual figures for varied lines of business, and I am presenting the figures for my business.

In 1920, 75 per cent of our sales were of standard machines. With the coming of the following depression special machines declined so that in 1921 80 per cent were standard and in 1922, 92 per cent were standard. That would seem to indicate that special machines receive the severest blow in a depression.

But in the present depression the result has been just the opposite. In 1929, 63 per cent of our output was of standard machines. In 1930 this had dropped to 48 per cent, and finally in 1934 but 29 per cent of our sales have been of standard machines.

So there does not seem to be any rule about it.

Jigs Bored on the Milling Machine

FRED B. JACOBS

When a jig borer is not available, the toolmaker can turn out an accurate job on the milling machine by using care and a little ingenuity. Here are some pointers on how to proceed

TO BORE drilling jigs accurately is one of the most difficult of toolroom operations because extreme care must be exercised at every point of the procedure. To bore two holes, for example, 3 in. apart, where a tolerance of 0.010 in. is allowed, is a simple matter; to bore the same holes within 0.001 in. of the desired dimension is a more difficult procedure. To space the holes with extreme accuracy, or as a toolmaker would say "as close as you can get them," is quite another story. The above expression often is loosely applied, but it generally means within a 0.0005-in. variation or less.

If the toolroom is equipped with a modern jig boring machine the process of accurate jig boring is simplified because such machines are precision tools of the highest order, designed especially for a given purpose. However, not all toolrooms are equipped with these precision machines, and for that reason other tools must be used, chief of which is the milling machine.

Such a machine, if used for jig boring, must be accurate as to parallelism between the platen and the spindle, and in a plain milling machine, the platen slots must be square with the spindle. With a universal miller, equipped with a swivel platen, it is a simple matter to set the platen square with the spindle by following the method shown in Fig. 1. In the center slot of the platen *A* is placed two size blocks *B*. The swinging arm *C*, with a contact block at one end, is clamped between the collars on the arbor *D*. By turning the spindle to bring the contact block opposite each size block and using a feeler gage, it is a simple matter to set the platen exactly square with the spindle.

The simple test shown in Fig. 2 may be made to ascertain whether the platen is parallel with the spindle. In this illustration *E* is an accurate test bar, and *F* is a dial indicator mounted on an ordinary surface gage. First the test bar must run absolutely true, which is readily determined by the test indicator. Then as the indicator is moved along the test bar any error in alignment is detected readily.

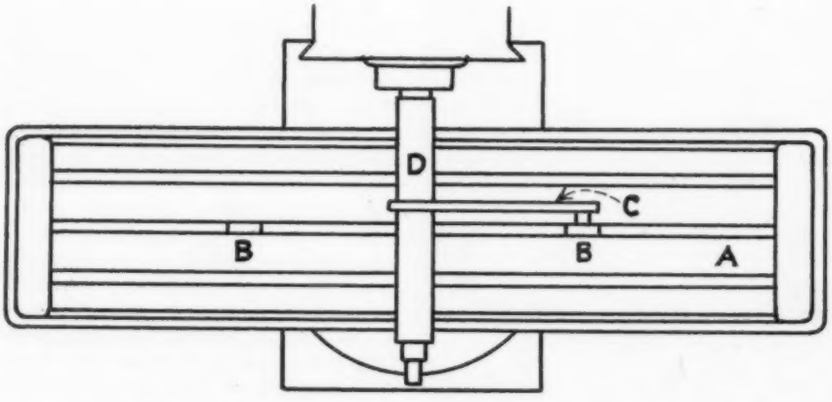


Fig. 1—To make sure machine alignment is correct in the first step; this can be done by using a contact block on a sweep

To illustrate a simple method for boring an accurate jig on the milling machine, that shown in Fig. 3 will serve as an example. This jig is for drilling four holes in a gear blank; two holes are for screws and two for dowel pins. The holes are 2½ in. apart on the diameter. This is a simple circular box jig with a cover or bushing plate held in place with one locating pin. In using such a jig, the operator drills one screw hole and puts a plug through the bushing into the hole; then he drills the other screw hole and the two dowel holes. The

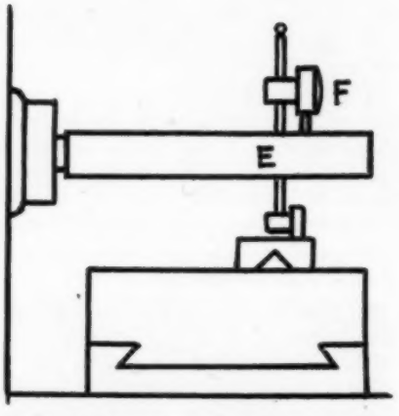


Fig. 2—Another simple test will show whether the platen is precisely parallel to the milling machine spindle

bushing plate is removed and the screw holes counterbored and the dowel holes reamed. While it is true that the design may be faulty according to some authorities, accuracy as to the spacing of the holes is very necessary.

The first step is to set four buttons in place. The tool designer should furnish the toolmaker with a layout as given in Fig. 4. This gives the dimensions across the holes both ways, which

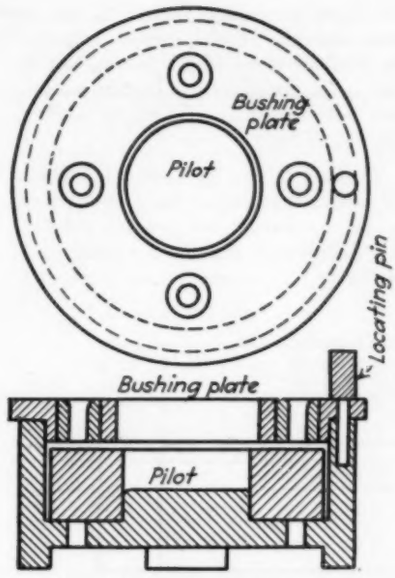


Fig. 3—A simple box drill jig serves an example in describing the method of laying out

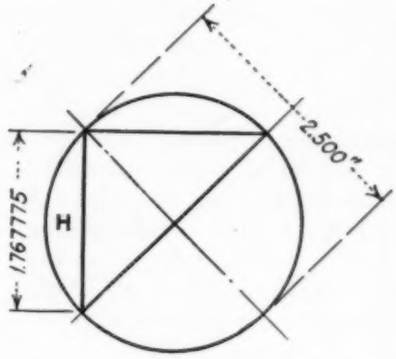


Fig. 4—The distance between adjacent holes should be furnished to the toolroom by the drawing office

information is needed to set the buttons necessary for boring the jig.

When this information is not supplied the toolmaker, he can readily calculate the center distance between adjacent holes. Since there are four holes in the example given, the center angle is 90 deg. and the two acute angles making up the triangle are each 45 deg. Then the center distance *H* equals 2.5 sin45 deg., or 2.5 × 0.70711, which equals 1.767775, or 1.768 in. In figuring out any trignometrical problem, never knock off any extra figures from any but the final result.

The next step is to lay off the holes as accurately as possible with a height gage and drill and tap for the little screws to hold the buttons in place. Then to facilitate the setting of the buttons centrally with the bushing plate, as they should be, turn up a plug 2½ in. in diameter less the diameter of the buttons to be used. This plug must have a boss to fit in the center hole of the bushing plate. Then set the buttons as accurately as possible to the dimensions given in Fig. 4.

In the boring operation the jig is strapped to an angle iron which is bolted to the milling machine platen. The angle iron must set square with both the platen and the spindle sweep as shown in Fig. 1. Then the buttons are trued up one at a time, removed and the holes drilled and bored. The buttons must be trued up with a sweep indicator as the object is to get the button axis exactly in line with the spindle axis. In Fig. 5 is shown a Starret indicator fastened to a piece of bent ¼ in. round cold-rolled steel which is gripped in the milling machine spindle chuck. To true up the button, the spindle is turned over slowly by hand and the platen set and reset until the indicator hand gives the same reading at four points. This is not a difficult procedure, although it is necessary to use a looking glass to read the indicator while it is upside down. It is, of course, understood that a dial indicator could be employed for the same purpose.

The average milling machine possesses one drawback when used for jig boring in that the in and out travel of the platen saddle is limited, which makes it difficult to get drills, boring bars, etc., in the spindle chuck. However, the difficulty is readily overcome by making up the few inexpensive tools shown in Fig. 6. In this illustration *J* is approximately 3½ in. long with a taper to fit the milling machine spindle. The hole is ⅝ in. in diameter, and a set screw is provided as shown. The tools *K*, *L*, and *M* are made long enough to be passed through the chuck *J* from the back of the spindle. The tool shown at *K* is an ordinary combination drill and countersink and is used for truing up the little hole that accommodated the jig button. The tool *L* is nothing but an extension drill, while *M* is a boring bar. In other words, the hole is centered, drilled and bored, one operation after another.

It is not absolutely necessary, of course, to bore the holes to any exact size as bushings are ground to fit them. However, if the holes are bored to some standard dimension, this will enable the operator to check his work after the jig is bored. Referring again to Fig. 6, the boring bar is fitted with a cutter held in place with a set screw. The back end of the hole for the cutter is tapped out to accommodate an adjusting screw. Thus the cutter can be set to remove a given amount with approximate accuracy. The fraction of a turn of the adjusting screw to remove a given amount from the hole in process of boring is determined by the pitch of the adjusting screw. By using a fine screw, 40 threads to the inch, the amount to turn the screw

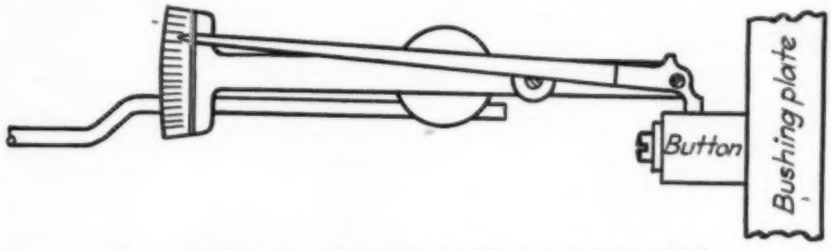


Fig. 5—Buttons may be centered with the machine spindle by means of an indicator supported by an offset rod

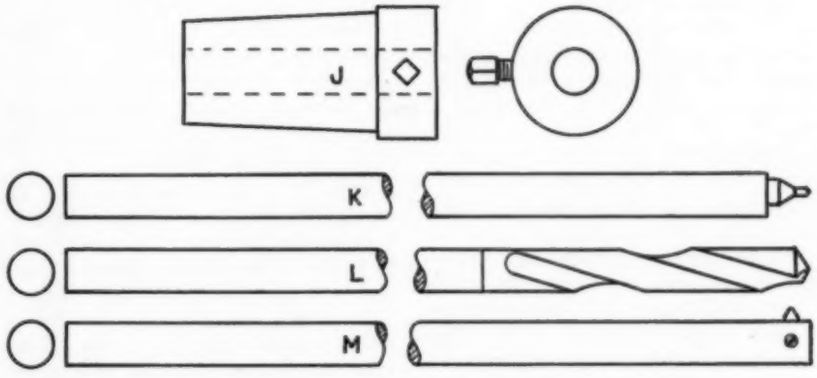


Fig. 6—These tools may come in handy in working at close quarters

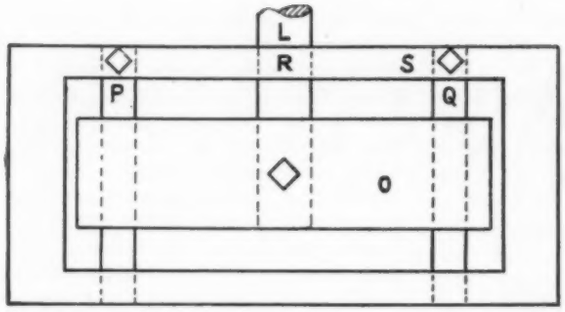


Fig. 7—Accurate alignment in constructions, such as that illustrated, may be obtained through the use of carefully made jigs

to remove a slight amount is approximated readily. For instance, one full turn would remove 0.050 in. from the hole, a half turn 0.025, a quarter turn 0.0125, an eighth turn 0.00625 in. and so on.

After all the holes in the jig are bored, one after another, they should be tested by the toolmaker before the work goes to the inspector. Thus the toolmaker has a chance to rectify his mistakes if any. The holes should be fitted with plugs to fill them exactly with push fits. These plugs can be turned from cold-rolled steel bar stock and finished by filing with a Swiss or Swiss pattern file, but the better plan is to finish them by grinding, using a tool-post grinder.

The holes should test to the dimensions given in the layout. If a hole shows out it is a simple matter to rebore it accurately. The work is again located on the milling machine platen, and the plug in the hole that is "out" is trued up carefully with the sweep indicator as described previously. Then as the toolmaker knows which way the hole is "out" he moves the milling machine platen the required distance to offset the error. In this operation he should rely wholly on the graduations on his indicator to make his setting. As a matter of fact, a skilled workman can move a hole over 0.0005 in. (or even less with a dial indicator) as readily as he could move it 0.010 in.

The foregoing method of jig boring can be relied on for extreme accuracy as it includes means for rectifying mistakes. One of the most accurate examples of jig boring is illustrated in Fig. 7. The part *O* has three holes and slides on rods *P* and *Q*, being fastened to rod *R*. The frame *S* also has three holes, and it is obvious that these must align with those in the part *O*. By following the foregoing method two jigs can be bored separately, and parts drilled and reamed in them should assemble as shown in Fig. 7 without any "doctoring" with aligning reamers.

If it is necessary to use a comparatively long boring bar to bore two holes in line with each other, the toolmaker sometimes supports the outer end of his boring bar by the center in the swing arm. This practice is to be discouraged as it generally results in inaccuracy as shown in Fig. 8. This illustration is exaggerated to illustrate the principle, and it shows that the boring bar is forced sidewise because of an inaccurate setting.

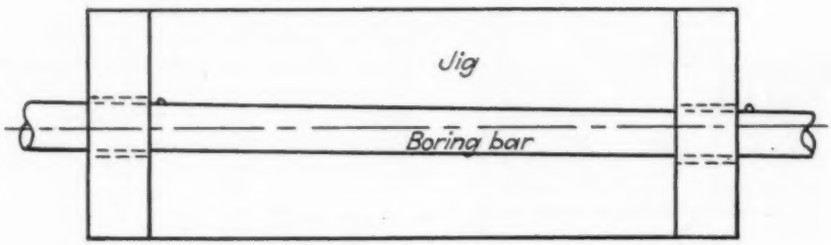


Fig. 8—It is not good practice to use the swing arm when boring two holes a considerable distance apart

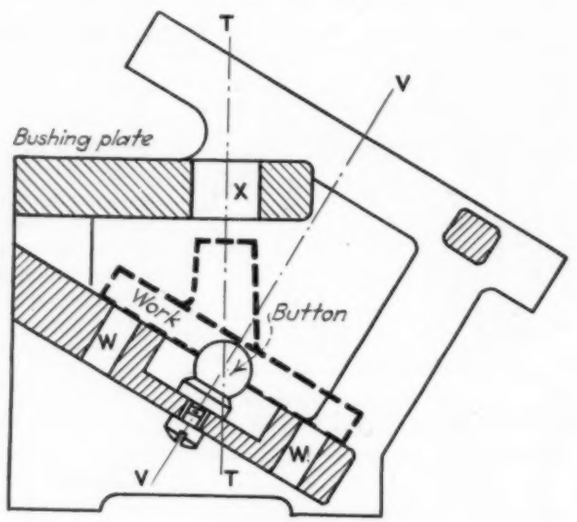


Fig. 9—Angular jigs are ticklish jobs which are often simplified by the use of spherical buttons

When it is necessary to bore a jig of this kind on the milling machine, bore one hole first with the tools shown in Fig. 6. Then clamp a piece of cast iron midway along the jig. Bore a hole in this piece, letting the boring bar run in the hole first bored. Then bore the hole at the outer end of the jig by supporting the boring bar in the two holes previously bored. If care is exercised, the results cannot help but be accurate even if the boring bar itself is sprung slightly. In this method one hole serves as a guide in machining the other.

If there is one jig boring job above all others that causes the average toolmaker to scratch his head in perplexity, it is boring angular jigs accurately. However, the operation is much simplified by using spherical buttons. Such an operation is shown in Fig. 9. The button must be made accurately, hardened, and finished by grinding in a spherical grinder. In other words, the ground portion must be truly spherical. Referring to Fig. 9, lines *T-T* and *V-V* must cross at a point exactly in line with the base of the work. Thus, it is evident why the jig base is recessed to accommodate the button. The button must of course be set in relation to the two holes *W* which are bored previously. It is understood that the bushing plate, with the hole *X*, is removable, so the toolmaker can get in with an indicator to true up the spherical bushing. Then the bushing plate is replaced and the hole *X* bored.

EDITORIALS

VOLUME 79 AMERICAN MACHINIST ESTABLISHED 1877 MCGRAW-HILL PUBLISHING COMPANY, INC. NUMBER 4

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EDITORS

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Hope for Industry

ALTHOUGH many of the proposals of the New Dealers are still sending cold shivers up and down the spines of the men who are trying to keep industry going, there are other actions that are highly hopeful. One of the most significant is Mr. Roosevelt's decision to renew the Automobile Code with its merit clause intact, and with the Wolman Board officially included as a code activity. This step offers convincing evidence that the President realizes how far organized labor leadership has come from living up to its opportunities or to its responsibilities, and it should fortify those members of Congress who have been too prone to heed the demands of the labor lobby, regardless of their merit.

But the relief from the threat of union labor dominance may well be looked upon as a neutral help—the removal of an obstacle. A positive one is to be found in the recent modification of RFC regulations under which loans will be made to satisfy, "on a compromise basis," existing indebtedness, provided: That the loan is necessary to increase or maintain the employment of labor; that it is adequately secured; and that the applicant has a good chance of continuous operation.

A much more radical change involves loans for the purchase of machinery. Here it is necessary to show an economic need and that production capacity will not be substantially increased. Also that not less than half the loan could be amortized by earnings in five years; in other words, that the machinery will pay for itself in ten years, a principle accepted and applied by many a successful manufacturing plant. This ten-year limit has been the basis of all three of *American Machinist's* surveys of obsolete equipment.

Furthermore, we have the interesting spectacle of both FHA and HOLC seeking the authority to extend industrial modernization loans that can be applied on machine replacements. And also the new authority of RFC to loan funds to finance sales of domestic electrical machinery and certain mining enterprises. Loans to industry by federal finance bodies have not got very far, largely because of the severe restrictions that surrounded them heretofore. But there is the cold fact that industrial reserves have been cut by at least one-third, which is a strong incentive to borrow easy money when replacements can no longer be postponed.

LASTLY, there is the growing interest in Washington in some plan that will permit buyers of capital goods for replacement of obsolete units to deduct sums so expended from their gross income in figuring tax returns. In our opinion this would be the most potent force of all in accelerating the breaking up of the depression jam which has already started to move. Truly there is hope for industry today that did not exist only a few months ago.

NRA on Automobile Labor

AS WE go to press Washington releases the study of conditions in the automobile manufacturing industry made by Leon Henderson and Hans Lansburgh of NRA's Research and Planning Division, and Dr. Isidore Lubin, Labor Department statistician. From the reports of this study printed in the daily newspapers one would surmise that work in an automobile factory is one step removed from the torments of Hades, and that slave-driving tactics are universal. It is also implied that the factory managers are doing something immoral in introducing machinery that reduces costs and widens markets, because at the same time it inevitably requires fewer men for a particular operation.

The newspaper reports are not quite fair to the job done by Mr. Henderson's committee. The committee took pains to point out some of the good things done by the automobile industry, such as spreading of work and high technical achievement, but some of its recommendations lead one to suspect that its members were not too well versed in modern manufacturing methods.

. CHIPS .

Washington—Party lines were broken as the Senate rejected a motion of adherence to the World Court . . . Roosevelt's defeat on this measure laid to organized propaganda of Coughlin and the Hearst publications, but senatorial distrust of European dictatorships may have had much to do with it . . . President promises early message on straight subsidies to shipping to replace mail subsidies . . . Passes on Howell Board report to Congress but would have control of aviation under ICC instead of under new commission called for in report . . . Industrial Advisory and Planning Board recommends establishment of a board to superintend relocation of part-time industries . . . Navy proposes replacement of auxiliary vessels to the extent of $150,000,000 during the next two years, also government aid in strengthening merchant marine.

Foreign—Japan puts pressure on China to form Oriental alliance . . . Soviets announce increase in regular army from a little over 500,000 men to nearly a million, with corresponding additions to equipment . . . Plan constitutional changes to liberalize voting and equalize classes . . . Delegates from U. S. and U.S.S.R. are elected at Geneva to International Labor Office . . . England and France reach agreement on plan to abrogate armament ban on Germany in exchange for return to League of Nations . . . British effort to nationalize dole fails after a month's trial.

Finance—Congress passes Administration's RFC extension measure with liberalized provisions to ease credit risk precautions, make possible term selling of domestic electric machinery outside TVA territory, aid real estate market . . . HOLC wants $1,250,000,000 more to take care of unfilled applications and to stimulate industrial modernization . . . Congress extends life of RFC for two years and broadens its powers . . . Trading on N. Y. Stock Exchange off one-half in 1934 . . . Plan for Washington building for Federal Reserve Board with provisions for additions indicates likelihood of absorbing other federal banking control bodies later . . . Administration banking bill is in for a fight in the Senate . . . AAA shake-up leaves Chester Davis in control, ousts several of the radical group.

Industry—U. S. Steel, in annual report, shows reduction of deficit from 42 to 28 millions . . . Automobile code is extended until June 16 despite angry protests of A. F. of L., and Wolman Board is made part of code, a new arrangement . . . Manufacturers agree to hold show in November and to announce new models in fall to lengthen employment period . . . Boulder Dam gates are closed 2½ years ahead of schedule and lake starts to form . . . National City Bank of N. Y. predicts best first quarter since 1931 . . . Reed-Prentice reports more business than at any time since 1929, Navy orders are partly responsible . . . Cost of administering NRA codes is upwards of $40,000,000 a year, code authority budgets being based on assessments running from 1/10 of 1 per cent to a few at 1 per cent or more.

Trade—Foreign trade was down for December but up for the year . . . Negotiations on Soviet debts break down and steps are taken to abolish First Export-Import Bank which no longer has a function . . . Reciprocal trade treaty signed with Brazil . . . Refusal to apply most-favored-nation principle by reducing Russian manganese duty 50 per cent, as provided for Brazilian manganese in reciprocal treaty, indicates active application of this policy toward countries that discriminate against U. S. products . . . Farm equipment exports in 1934 nearly doubled those of 1933.

Indicators—Steel production levels off at better than 55 per cent of capacity . . . Carloadings up but electric power output recedes lightly . . . *Business Week's* index rises to 65.1.

30-Hour Week Hot Topic At NRA Labor Hearing

WASHINGTON—The one most clearly indicated result of the generally incoherent picture drawn during the four days of NRA's open forum on labor policies is an intensifying battle royal over maximum work hours, with considerable likelihood that the code structure in this particular will be revised downward.

This does not mean the 30-hour week, which was the subject of much of the bitterest fighting at the hearings. However, in the face of the continued pressure from the American Federation of Labor for this limit, NRA hopes partially to meet labor demands by persuading many industries now working more than 40 hours to cut to the level of most codes, and likewise aspires to bring under existing hour provisions many classes of workers now exempted completely.

Witnesses Shape Thinking

With no clearly defined advance policy on labor provisions NRA discarded the steam roller technique used during the first policy hearing on prices and at the opening of the labor session intentionally set opposite each other the most partisan witnesses available in the hope that new information would come out of discord. Very little did. In cross-questioning witnesses the NRA administrative Board clearly revealed that it is as badly split on labor questions as is the public.

The arguments offered at the hearing, while old, did shape up in somewhat different proportions than heretofore, with the result that certain trends became emphasized more than in the past. Maximum hours is the biggest issue and tied with it is organized labor's demand for more representation on the NRA board and on code authorities.

The industrial board wrote no speeches, however, leaving this to their witnesses themselves. Industry lined up in the main for the rising volume of production theory for increasing employment, and universally denounced the 30-hour week. Further increases in minimum wages were also decried. Some industrial witnesses sided with those of the NRA board who want simplification of labor provisions, but pointed out the myriads of difficulties which will make this move slow and difficult. Several witnesses protested strongly against overlapping codes, and small troublesome inequities in several codes.

A few witnesses, led by Ralph Flanders, president of Jones & Lamson Machine Co., favored uniform hours with extra pay for overtime work, but on the whole the school of thought within NRA which desires such a move did not receive particular aid. Nevertheless, this segment of the recovery administration, which incidentally includes more representatives of the industrial viewpoint than of the labor, is still standing by its guns, contending that generally enforced fluctuations in seasonal industries make it necessary to permit overtime work. Holding also that maximum hours are a sociological rather than an economic consideration this group believes that in periods of high business activity and earnings, extra pay for overtime would force distribution of more profits to workers. It is definitely not believed that curtailed work hours mean more employment in the long run. It is admitted that industry generally is hard to win over to the idea of extra pay rates for overtime.

This advocacy of universal overtime rates in codes has not yet assumed such proportions in NRA as to indicate early translation into action, but it is spreading rapidly enough to be a factor worth watching.

Wages above the minimum and geographical and sex differentials in wage rates received comparatively little attention at the hearing, much to NRA's surprise. These are subjects on which there is admittedly no policy and Board members would have preferred some light on them.

A. F. of L. Complains

The howling of the American Federation of Labor over the extension of the automobile code probably will not result in the final break with the Administration that surface appearances indicate.

William Green apparently feels that it is good politics to denounce the government. He has done so every time the motor code has been extended, but just as soon as some other labor problem arises in the NRA he is right back with the Labor Advisory Board taking as much part as possible in the solution. Even as he washed his hands of the auto negotiations claiming he would rather see no code at all than extension on February 1, he was demanding greater A. F. of L. representation on the NRA Administration Board and more labor representation on code authorities.

It is true that in the latest auto squabble the Federation went farther than usual in its condemnation, to the obvious disgust of the Administration, particularly NRA. But New Dealers know that while Mr. Green's agency has been revealed as of small consequence in the auto field, there are industries in which the Federation is important, so it cannot be forever ignored henceforth.

Coordinating Transportation

President Roosevelt will give Congress the signal to go ahead on a new transportation law in the very near future. He is waiting to throw on the green light only until Postmaster General Farley and Secretary Roper's interdepartmental committee submit reports on mail contracting that, in future, will be divorced from the subsidies that may be necessary to keep our merchant marine afloat and our planes in the air.

Consolidating regulation of land, water and air transportation in ICC, the bill will include so much that each type of transportation wants that its prospect of enactment is very good indeed. The railroads grouse, of course, at Transportation Coordinator Eastman's proposal to perpetuate his rôle of coordinator but he has demonstrated its nuisance value and the President is likely to uphold him.

Taxes and Deductions

Another step being considered to stimulate the heavy industries is to allow a deduction from the income tax for the full amount of expenditures for new machinery and other equipment. Ordinarily machinery depreciation is written off in five or more years.

Changes in the tax on capital gains and losses again are under consideration. Serious thought is being given the abandoning altogether of taxation of capital gains so as to remove the deterrent on the natural and ordinary liquidation of securities on a rising market.

Economic Security

The Economic Security bill is having rough sledding; even the A. F. of L. is against it in its present form, demanding that the state-encouragement plan of the Wagner bill be scrapped for a federal subsidy plan with definite and exact standards in every direction. Green's testimony at the Capitol bore out previous indications that the advice of the Advisory Board to the

Committee on Economic Security was pretty completely ignored by the cabinet officers making up the committee, as well as by Senator Wagner and Representatives Lewis and Doughton.

One of many wild bills on this topic was introduced last week, by Rep. Lundeen, as the "workers' bill." It provides for everybody over 18 who is out of a job to get weekly payments the same as the "prevailing wage" in their locality. The money would be taken from inheritances, gifts and corporate incomes of over $5,000 a year. Chairman Connery of the House Labor Committee, father of the 30-Hour Week bill, supports this measure.

The 30-Hour Week bill continues to be a menace. Immediately on the defeat of the A. F. of L. on the auto code extension and the cold reception of the demands for compulsory shortened hours under the codes (at the NRA hearing), Green demanded of Congress the enactment of the compulsory 30-hour bill as the only way to save the country.

National Planning

National planning is catching up with the procession with more speed than was recently indicated. National Resources Board report was transmitted to Congress by the President this week with a significant message. He ties National Resources Board (and Mississippi Valley Board report also) in with the $4,000,000,000 work-relief plan, urges permanent national resources board (he carefully avoids calling it a "planning" board, and says:

"Our goal must be a national one. Achievements in the arts of communication, of transportation, of mechanized production, of agriculture, of mining and power, do not minimize the rights of State governments, but they go far beyond the economics of State boundaries."

Senate efforts to circumscribe the broad powers granted to the President in the $4,880,000,000 work relief bill gathered force as the Appropriations Committee tried vainly to discover what projects and which agencies will be involved in the program. If action is delayed, it is possible that a separate bill will be shoved through to release the $880,000,000 of unexpended balances to carry the FERA whose funds will be exhausted February 10. Administrator Harry L. Hopkins estimates that $750,000,000 will be needed between then and June 30.

Second 5-Year Plan for Soviet Machine Building Industry

1. Amur Shipbuilding Plant;
2. Cheliabinsk Roller Bearing Plant (24,000,000 bearings per year);
3. Gorki Automobile Plant (300,000 cars per year);
4. Gorki Milling Machine Plant;
5. Irkutsk Car Works (10,000 freight cars per year);
6. Jaroslavl Motor Truck Plant (25,000 5-ton trucks per year);
7. Kamensk Motor Truck Plant (100,000 3-ton trucks per year);
8. Kashira Electro-Locomotive Plant (300 electro-locomotives per year);
9. Kazan Car Works;
10. Kharkov Drilling and Grinding Machines Plant;
11. Kharkov Turbine Plant;
12. Kiev Automatic Machines Plant;
13. Komsomolsk Shipbuilding Plant;
14. Kramatorsky Heavy Machinery Plant (165,000 tons per year);
15. Kuznetzk Car Works (10,000 freight cars per year);
16. Lugansk Locomotive Plant (1080 locomotives per year);
17. Moscow Automobile Plant (80,000 cars per year);
18. Moscow Lathe Plants (two plants);
19. Novocherkassk Locomotive Plant;
20. Orsk Locomotive (steam and diesel) Plant (1,000 locomotives);
21. Samara Carburetor Plant;
22. Samara Motor Truck Plant (25,000 5-ton trucks);
23. Saratov Gear Shaper Plant;
24. Stalingrad Motor Truck Plant (100,000 3-ton trucks);
25. Ufa Gasoline Engine Plant (50,000 engines);
26. Ural Heavy Machinery Plant (100,000 tons yearly);
27. Ural Car Works (54,000 freight cars);
28. Ural Chemical Machinery Plant;
29. Ural Electrical Instruments Plant;
30. Voronesh Grinding Machines Plant;
31. Nine Central R.R. Car Repairing Plants;
32. Three Central Locomotive Repair Plants;
33. Four Transport Equipment Plants;

and a number of plants for manufacturing small tools; textile machinery; canning machinery; pulp and paper machinery, etc.

Soviets 5-Year Plan Includes Huge Plants

In the Soviet Russian "Bulletin of the Financial and Economic Laws," for Dec. 30, 1934, appears the official text of the Second 5-Year Plan, with details of the capital investments of the Russian government in its industries for the years 1934-1937. The total is about $54,000,000,000. Much of the machinery and equipment will have to be bought abroad.

Breakdown of the debt negotiations between the Soviets and the United States bars the way to government financing of the important share of this business that should have come to this country. Unless we are to lose practically all of this vast market to European competitors some means of financing Soviet orders privately will have to be worked out.

A partial list of the plants to be built or completed before the end of 1937 is given in the accompanying table.

'35 Machine Tool Show Will Dwarf '29 Exhibit

Applications to date for space at the Machine Tool Exposition for 1935, to be held in Cleveland, Sept. 10-21, under the auspices of the National Machine Tool Builders' Association, require a total exhibit area 50 per cent larger than the show of 1929. Therefore the association has decided to lease all additional space in the Public Auditorium to accommodate companies in the accessory field. A total of 250,000 sq. ft. of floor space will be utilized. Applications for space have already been received from 110 member companies and from 75 accessory companies, and it is anticipated that the exhibition will be a sell-out months in advance of the opening.

NRA Rules 7-Day Basis for Piecework

Payment to employees in codified industries engaged on a piece-work basis must be computed for not more than seven consecutive days, and must not be less than the minimum hourly rate specified by the code, according to the recent ruling by the National Industrial Recovery Board. This ruling was contained in an interpretation of code provisions extending minimum hourly rates of pay to piece-workers.

Automobile Output Approaches Records of 1929

DETROIT—With January output running in the neighborhood of 300,000 units, the industry enjoyed the greatest first month output of any year with the exception of 1929. In January of last year only 157,000 units were produced but strikes and labor difficulties accounted for much of this slow start, which conditions were absent this year. February output is expected to run ahead of January; Ford schedules are to be boosted to 130,000; Chevrolet estimates 85,000 with 135,000 in March; Buick and Pontiac have boosted January schedules several times and Olds is hitting for 2,000 per day. Ford reached a total of 5,000 per day the last week in January and the Packard light car is expected to run to an output of 2,000 this month. An output of 80,000 for all Chrysler units is expected for February and Graham plans to reach 300 per day during this month. Hudson schedules for both January and February stand at 10,000.

With most manufacturing representatives plugged with all the business they can take for weeks ahead, there is still a note of skepticism or perhaps a wish that the industry had not started with such a rush. There is also somewhat of an undertone of belief that the high production may be due partially to anticipated labor troubles. Undoubtedly there is considerable jockeying to get the jump on competitors, who are a little slow in getting into production, especially in the low priced field.

Comprehensive figures on sales are not yet available, but random samples indicate that considerable justification exists for high output. 5,438 passenger cars were sold in Detroit in January, the previous peak being 5,313 units in 1929. Delivery on a number of models cannot now be made, but orders are taken with promises for the middle or the last of the month. Retail sales of Plymouth and Chrysler cars by Chrysler dealers increased 16.1 per cent for the week ending January 19 over the previous week. In the first three weeks of 1935 over 180 per cent more care were delivered by these dealers than in 1934. Sales of Dodge and Plymouth cars by Dodge dealers to January 26 show an increase of 125 per cent over last year. Ford truck sales for the first 20 days of January were about three times as great as the same period last year.

The results of recent elections for worker representatives held by the automotive board is distinctly encouraging toward clearing the atmosphere as to what the worker wants. The Wolman Board announced on January 24 that out of a total of 38,336 votes cast to that date, 34,273 workers recorded themselves as not affiliated with any labor organization. Communistic affiliates polled only 14 votes out of this total; the A. F. of L. polled slightly over 5 per cent or 1,847.

The A. F. of L. claims the vote is not an indication of their strength due to orders to their members to abstain from voting. However this is meaningless since the same figures show that 90 per cent of those eligible to vote did so. This organization has claimed that a majority should speak for all the workers and it is now evident that no organization, not even the Works Councils, have this mandate. The elections, with all paraphernalia, including voting booths, are carted around to the various plants by board workers and the boxes are sealed and returned to the Board offices for count.

Doubt exists that the federation will conduct its announced drive in the spring for new members on the face of this unfavorable showing.

The fate of works councils is as yet in doubt. At the Cadillac plant all members elected with one exception were Works Council members. Should this not be generally true, no tears are likely to be shed by managements; they have contended for proportional rather than majority representation which is the line followed by the Board. The percentage of eligible voters voting has increased from plant to plant, evidencing increased worker interest.

Labor

While the figures just quoted clear the atmosphere, there is still plenty of explosive material at hand. Tie-ups through intimidation and fear are

• INDUSTRIAL REVIEW •

• On the whole the machinery trade is sticking by the feeling of optimism with which it started 1935. There are sections where the failure to close orders is causing some disquiet, but they are outnumbered by the districts that are finding continued interest and willingness to buy. Fear of labor troubles does not seem to be worrying many people but there is a feeling that delay on the gold clause decision has held up some potential business.

• February opened up well ahead of January in the New England territory and distributors there are encouraged. In the metropolitan district and in up-State New York, shops are busier and men are being taken on, but there is a distinct reluctance to close machine tool orders. Inquiries in the Pittsburgh district are fairly good but no orders of any size are being released. The continued rise of steel activity has encouraged everyone. Cleveland expects to have the best first quarter since 1930. Inquiries are increasing and customers act more quickly.

• In Cincinnati there seems to be a lull. January was good and the prospects for the first quarter are still favorable. Inquiries are still fair but not up to the December level. Matters are moving briskly in St. Louis and the trade optimistic for the first half of the year. Some business is being placed and more is in prospect. Orders and inquiries both are in fair volume in Indianapolis and the first quarter will be the best since 1931. The labor situation is clearing up somewhat and distributors are hopeful. Extension of the Automobile Code has helped prospects in Detroit and machine tool orders are on the increase. Supply business is good but still on a hand-to-mouth basis. Business is improving steadily in Toledo, thanks largely to the automobile activity. Inquiries are numerous but the percentage of closings is rather small.

• January was a satisfactory month in Chicago and February holds promise of being even better. There are plenty of good, live inquiries to work on. In Milwaukee there is a threat of labor trouble in the metal-working plants. Orders and inquiries are scarce. January business was very small in the Northwest and prospects for February are not particularly bright.

Head-on view of The Flying Yankee, first of the streamlined trains for the East, and a view of the nose before the skin was put on. Built by the Edward G. Budd Mfg. Co. for the Boston & Maine and the Maine Central, this 3-car articulated train, powered by a 600-hp. Winton diesel, is designed for speeds of 100 mi. per hr., and is expected to cut a third from the running time between Bangor and Boston, and to halve the cost.

possible, even with a scant 10 per cent to do the intimidating. The industry is vulnerable in several spots. The present glass strike in the Pittsburgh plants is an example. The demands are for a 20c per hour increase and the check-off made by an affiliate of the A. F. of L. having 20 percent of the workers. Negotiations are being carried on in Toledo at present. If this difficulty is protracted it will close assembly plants.

Approximately 14,000 workers at the Olds and Fisher plants in Lansing were thrown out of work temporarily Thursday, January 31, by a strike of 20 sanders in the Fisher plant, only a 2½ hour notice of the strike being given to the management.

The new Cadillac bargaining agency at its first meeting called upon all similarly elected groups to unite in a national organization, paralleling the A. F. of L. Meanwhile the M. E. S. A., showing negligible strength at present, has decided upon a new campaign for members.

It would seem that, with such strong worker preference for non-affiliation with outside organizations, with their growing confidence in the disinterestedness of the Labor Board together with the desire of managements to meet the wishes of the workers, evidenced on a wide scale by the adoption of the straight day rate, the scales are tipped against major disturbances.

Code Changes

The code was extended to June 16 by the President on Jan. 31. Two amendments are included: the first, while not changing the hour provisions, provided that time and a half is the amount to be paid for time in excess of 48 hours per week, and the second "requested and authorized" the companies to announce new models in the fall.

The A. M. A. announced on the second amendment that agreement had been reached to bring out new models within 60 days on either side of October 1, with the show to be held the first of November.

Replacements and the duplicating of existing dies, machine rebuilding, and some new business is expected to keep tool and die shops busy for several weeks, some being full for six weeks ahead. Machinery dealers are busy quoting on new jobs but all too frequently encounter the experience of one who, after making seven layouts for a prospect, found the business relegated to old equipment in the plant. This and extensive servicing charges on equipment which is sold go a long way in explaining the price of equipment.

• PERSONALS •

DR. LILLIAN M. GILBRETH of Montclair, N. J., has been appointed professor of management at Purdue University, effective in September. Dr. Gilbreth has served as management engineer to the industries and the government of this country and leading organizations in Europe. She holds degrees from California, Brown, Michigan, Rutgers and Russell Sage.

E. L. BATES, of Borton & Co., Cleveland, was elected vice-president of the Fostoria Pressed Steel Co., Fostoria, Ohio, to succeed E. W. ALLEN. C. D. PIFER, president and general manager, and R. J. CARTER, secretary and treasurer, were re-elected.

FRANK E. EBERHARDT has been elected president of the Newark Gear Cutting Machine Co. Other officers chosen are: V. SETH EBERHARDT, vice-president and treasurer; HENRY J. EBERHARDT, secretary.

J. H. HOOT has resigned as vice-president and assistant treasurer of the Alliance Machine Co., Alliance, Ohio. ROBERT J. HARRY, former sales manager, has been appointed general manager of the same company.

SYLVESTER A. MAHON has been appointed works manager of the Philadelphia plant of the Edward G. Budd Mfg. Co., and JOSEPH W. MEADOWCROFT is now assistant works manager.

A. P. MUNNING, a member of the board of directors of the Hanson-Van Winkle-Munning Co., Matawan, N. J., who retired from active participation in the affairs of the company in March, 1930, is now occupying a high executive position in that company.

A. T. PERKINS was chosen president of the Webster Mfg. Co., Tiffin, Ohio, at the annual meeting. Other officers are: E. P. MCPHERSON, vice-president; CHARLES S. CLARKE, secretary-treasurer.

DONALD S. SAMMIS, town manager of Stratford, Conn., 1932-1934, has been appointed to the position of superintendent of the Bridgeport factory of the Underwood Elliott Fisher Co.

A. H. SKAER has been placed in charge of the Cochise Rock Drill Mfg. Co., Los Angeles, Cal., a subsidiary of the Independent Pneumatic Tool Co. Mr. Skaer was formerly president of Denver Rock Drill Mfg. Co.

A. R. SMALL, president of Underwriters' Laboratories, Chicago, Ill., is now a member of the American Standards Association. He will represent the Fire Protection Group.

GEORGE E. OSBORN

GEORGE E. OSBORN has been appointed vice-president and general manager of the Lamson & Sessions Co., Western subsidiary of the Lamson & Sessions Co. of Cleveland, to fill the vacancy caused by the death of A. J. BOYLE. He joined the company in 1920 in a sales capacity. GEORGE S. CASE, JR., has been appointed assistant general manager. He became affiliated with the company in 1930.

CLIFFORD S. STILWELL

CLIFFORD S. STILWELL, formerly sales manager of the Warner & Swasey Co., Cleveland, Ohio, has been elected vice-president of that company. Mr. Stilwell has been with the company for 23 years. After graduating from Denison University, he went through the company's apprentice course, and then joined the sales department in the Chicago district. For 14 years he was Detroit district manager.

Exports of Machinery During December, 1934

	December 1934	November 1934	December 1933
Electrical machinery	$5,865,864	$6,814,603	$5,492,096
Power generating machinery (except automotive and electric)	589,671	980,303	480,064
Construction and conveying machinery	467,978	416,153	295,208
Mining, well and pumping machinery	2,404,071	2,373,085	1,466,273
Power-driven, metal-working machinery	1,656,697	1,549,097	879,333
Other metal-working machinery	179,057	174,063	119,588
Textile machinery	759,318	522,969	585,398

Exports of Metal-Working Machinery During December, 1934

	December 1934	November 1934	December 1933
Engine lathes	$41,732	$80,923	$30,183
Turret lathes	39,700	37,044	4,849
Other lathes	25,469	50,588	21,334
Vertical boring mills and chucking machines	91,171	30,090	6,625
Thread cutting and automatic screw machines	51,379	32,916	86,540
Knee and column type milling machines	53,413	43,455	26,112
Other milling machines	102,485	89,183	64,748
Gear cutting machines	74,528	143,633	50,288
Vertical drilling machines	5,542	16,672	9,837
Radial drilling machines	12,467	5,130	4,440
Other drilling machines	89,581	63,625	37,926
Planers and shapers	28,672	22,685	7,996
Surface grinding machines	17,156	31,822	53,402
External cylindrical grinding machines	65,067	15,694	35,741
Internal grinding machines	95,245	64,326	47,386
Tool grinding, cutter grinding and universal grinding machines	42,246	73,282	25,156
Other metal-grinding machines	38,338	43,959	14,521
Sheet and plate metal-working machines	111,511	151,544	143,346
Forging machinery	135,147	76,405	24,309
Rolling mill machinery	239,884	169,673	17,417
Foundry and molding equipment	30,830	67,439	19,344
Other power-driven metal-working machinery and parts	265,134	239,009	147,833

Other Metal-Working Machinery

Pneumatic portable tools	50,407	45,915	32,253
Other portable and hand or foot operated metal-working machines and parts	53,017	39,735	37,768
Chucks for machine tools	10,149	12,037	11,530
Machine operated pipe and thread cutters, stocks, dies, taps, and other machine-operated cutting tools	46,005	56,888	21,432
Other metal-working machine tools	19,479	19,488	16,605

• OBITUARIES •

ALFRED P. BOLLER JR., who perfected units of sugar plantation machinery in the Hawaiian Islands, died Jan. 14 at the age of 65. In 1914 he entered the employ of the Stanley Rule & Level Co., New Britian, Conn., as consulting engineer and retired in 1931. Mr. Boller was a member of the A.S.M.E.

FRANK B. BUMBAUGH, 71, president of the Monessen Foundry & Machine Co., Monessen, Pa., died Feb. 1 at his home in that city, following a brief illness. With his brother, he founded the company in 1898.

WILLIAM H. DOTTER, 68, president of the Frog Switch Mfg. Co., Carlisle, Pa., died at his home in that city Jan. 19. He had been identified with that company for 50 years, 30 of which were as general superintendent.

JAMES E. HIGGINS, formerly superintendent of the Whitcomb Foundry and New England salesman for Reed-Prentice Corp., Worcester, Mass., for over ten years, died Jan. 14.

• BUSINESS ITEMS •

Marburg Brothers, Inc., 90 West St., New York, N. Y., are now exclusive distributors for the Moore jig boring machine, manufactured by the Moore Special Tool Co., Bridgeport, Conn.

The Gisholt Machine Co., Madison. Wis., announces the opening of its new Eastern District sales office at 538 Industrial Bldg., 1060 Broad St., Newark, N. J. R. D. HEFLIN is in charge.

The Case Hardening Service Co., 2281 Scranton Rd., Cleveland, Ohio, has been appointed by the Hevi Duty Electric Co., of Milwaukee, Wis., as representative for Ohio for service and sale of electric heat-treating furnaces.

The Palmer-Bee Co., Detroit, Mich., manufacturers of conveying machinery, speed reducers, and power transmission machinery, has appointed the Special Equipment Co., 155 N. Clark St., Chicago, Ill., with branch office in Cincinnati, as district distributors of its line. The conveyor division of the latter company will be under the supervision of W. H. ARGABRITE, formerly vice-president of the Alvey-Ferguson Co.

Bryant Machinery & Engineering Co., 400 W. Madison St., Chicago, Ill., has been appointed exclusive agent for the De Vlieg Milling Machine Co. in the Chicago and St. Louis territories.

Gropler Brothers, 105 Hudson St., New York, N. Y., sales representatives for the Federal-Mogul Corp., the Gairing Tool Co., the Gammons-Holman Co,. and the Madison Mfg. Co., have moved to 1060 Broad St., Newark, N. J. At their new address they will operate as Ernest T. Gropler Co.

The W. G. Nichol Co., machine tool dealers, announces the removal of its offices from the former address of 1010 Mariner Tower, Milwaukee, Wis., to 709-711 W. Michigan St., of the same city.

The name of the Gilby Wire Co., Newark, N. J., has been changed to Wilbur B. Driver Co. The change is wholly in name.

• MEETINGS •

AMERICAN MANAGEMENT ASSOCIATION. Joint conference of the Job Order and Mass Production Divisions, April 18-19. Hotel Statler, Cleveland. American Management Association, 20 Vesey St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Machine Shop Practice Meeting and Exhibit, afternoon and evening, March 28. Engineering Bldg., 205 W. Wacker Drive, Chicago. C. B. COLE, chairman, 4625 Fulton St., Chicago, Ill.

WELDING CONFERENCE. Fourth annual welding conference conducted by the department of industrial engineering, Ohio State University, Feb. 28-Mar. 1, at Industrial Engineering Building. Address Asst. Prof. O. D. Rickly, Ohio State University, Columbus, Ohio.

• PATENTS •

January 15, 1935

Metal-Working Machinery

Welding Apparatus. John L. Brown, Verona, and Theodore C. Fockler, Wilkinsburg, Pa., assigned to Westinghouse Elec. & Mfg. Co. Patent 1,987,664.

Portable Grinding Machine. Arthur W. Mall, Chicago, Ill. Patent 1,987,837.

Machine for Cutting Rivets. Adin U. Kerns, Altoona, Pa. Patent 1,987,957.

Apparatus for Surface Finishing the Side Walls of Slots. Frederick W. Trendell, London, England, assigned to Clement Talbor, Ltd., London. Patent 1,988,025.

Flying Shear. Edward T. Peterson, Reading, Pa. Patent 1,988,215.

Metal Working Machine. Gothard T. Moo, Cranston, R. I., assigned to Brown & Sharpe Mfg. Co. Patent 1,988,326.

Machine Tool. Charles H. Schurr and Homer C. Warner, Cleveland, O., assigned to the Lees-Bradner Co. Patent 1,988,424.

Tools and Attachments

Thread Cutting Die. Luben Nikoloff, Boston, Mass. Patent 1,988,046.

Tool Slide Assembly. George F. Yager, Toledo, O., assigned to the Bunting Brass & Bronze Co. Patent 1,988,228.

Trip Mechanism for Punch Presses. Frank S. Aliano, Brooklyn, N. Y. Patent 1,988,103.

Stock Feeder for Punch Presses. Andrew Raichem, Quincy, Mass., assigned to National Marking Machine Co. Patent 1,988,284.

Processes

Method of Generating Worms. Nikola Trbojevich, Detroit, Mich. Patent 1,987,877.

January 22, 1935

Metal-Working Machinery

Die-Casting Machine. Charles Pack, Jackson Heights, N. Y. Patent 1,988,506.

Milling Machine for Cam Shafts and the Like. William Sinclair, Detroit, Mich., assigned to Production Engineering Co. Patent 1,988,520.

Electric Welding Machine. Louis Breguet, Paris, France, assigned to Societe Anonyme des Ateliers d'Aviation Louis Breguet. Patent 1,988,537.

Punch Press. Medard F. Bollaert, Oakland, Calif. Patent 1,988,935.

January 29, 1935

Metal-Working Machinery

Apparatus for Electric Welding. George E. Markley, Cleveland Heights, Ohio. Patent 1,989,172.

Method of and Apparatus for Die Casting. Herbert J. Woock and Edwin A. Glynn, Lodi, Calif., assigned to Super Mold Corp. Patent 1,989,438.

Seaming Machine. Arthur G. Hopkins, Maspeth, N. Y., assigned to Metal Package Corp. Patent 1,989,518.

Tools and Attachments

Boring Tool. Clarence C. Craley, Shillington, Pa. Patent 1,989,227.

Temporary Blanking Mechanism. Stanley A. Gruchacz, Bloomfield, N. J., assigned to Monroe Calculating Machine Co. Patent 1,989,412.

Spacing Apparatus for Punch Presses and the Like. Lloyd E. Anderson, Des Moines, Iowa, assigned to Pittsburgh Des Moines Steel Co. Patent 1,989,071.

Shank Collar for Boring, Drilling, Punching and Like Tools, and in Appliances for Attaching the Same. Hans Köhlen, Rosslau, near Dessau, Germany, assigned to Flottmann, Aktiengesellschaft. Patent 1,989,171.

Operating Mechanism for Metal Cutting Shears. Myles Morgan, Worcester, Mass., assigned to Morgan Construction Co. Patent 1,989,331.

Safety Means for Swaging Machines. Charles T. Brennan, Cheshire, Conn. Patent 1,989,397.

February 5, 1935

Metal-Working Machinery

Apparatus for Die Casting. William M. Lester, Shaker Heights, Ohio. Patent 1,989,812.

Die Lapping Machine. Philip J. Helmstadter, McKeesport, Pa., assigned to Firth-Sterling Steel Co. Patent 1,990,074.

Annealing, Forming and Cutting Machine. Sverre Quisling, Madison, Wis. Patent 1,990,092.

Automatic Tapping and Drilling Machine. William Kabbel, Milwaukee, Wis. Patent 1,990,188.

Gear Finishing Machine. Edward W. Miller, Springfield, Vt., assigned to the Fellows Gear Shaping Co. Patent 1,990,239.

Machine for Flanging Sheet-Metal Plates, Xaver Sonntag, Reute, near Waldsee, Germany. Patent 1,990,255.

Tools and Attachments

Cutter for Forming Twist Drills. Harry A. Covill, Royal Oak, Mich., assigned to National Twist Drill Co. Patent 1,989,667.

Automatic Machine Tool. Joseph C. Drader, Detroit, Mich., assigned to Michigan Tool Co. Patent 1,989,792.

Machine Tool. Robert C. Wwishampel, Paterson, N. J., assigned to P. Frank Sonnek and Theophile J. Galipo. Patent 1,989,835.

Electric Small Tool. Franz Kratz and Ernst Baumgratz, Stuttgart, Germany, assigned to Robert Bosch Aktiengesellschaft. Patent 1,990,036.

Cutting Tool. Isodore B. Rosenberg, Port Chester, N. Y. Patent 1,990,310.

Honing Tool. Fred M. Kern, Detroit, Mich., assigned to Micromatic Hone Corp. Patent 1,990,331.

American Machinist
REFERENCE BOOK SHEET ©

Grinding Cemented-Carbide Tools

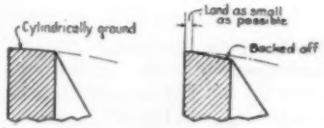
Milling Cutters

Courtesy of The Carborundum Company

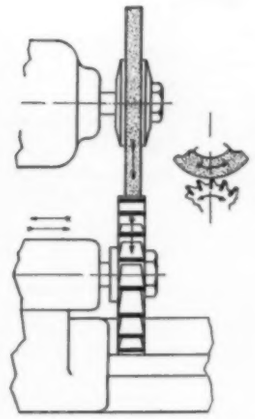
Solid-tooth milling cutters are best ground by cylindrically grinding the periphery of the teeth to insure uniform tooth height, and then grinding the clearance, (backing off), on a cup wheel, leaving a land a few thousandths wide at the cutting edge. The sides of the teeth are ground by rotating the tool against the wheel to insure them being the same height and backed off as before. Lapping is recommended.

General instructions:

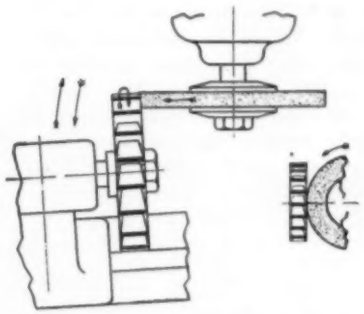
1. Use light pressures and feeds.
2. Traverse the work across the face of the wheel.
3. Grind against the cutting edge, holding the cutter firmly against the finger.



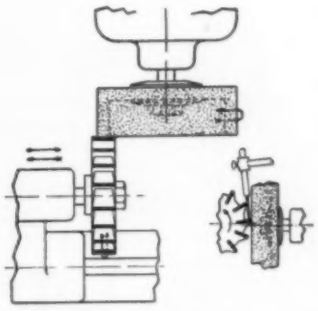
Solid-Tooth Milling Cutters



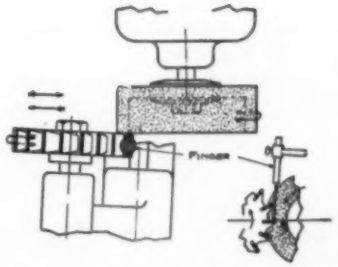
1 Set up tool in arbor and grind the O.D. on the periphery of a plain wheel



2. Turn wheel head and grind the sides of the teeth by rotating the cutter as in 1.



3 Mount a cup wheel and set wheel head and cutter on finger to correct angle for the backing off, and grind the clearance on each tooth leaving a land a few thousandths wide at the cutting edge.



4. Repeat 3. for the sides of the teeth.

NOTE. A power driven arbor is recommended for operations 1 and 2 so that the work speed is constant, thus insuring uniform tooth height.

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Grinding Cemented-Carbide Tools

Milling Cutters

Courtesy of The Carborundum Company

Inserted-tooth face milling cutters may be sharpened in several ways, but the method described is that of cylindrically grinding the periphery and faces of the teeth on a plain wheel and then backing off each tooth on the side of a cup wheel, leaving a slight land at the cutting edge. This method insures the teeth being of uniform height which is of importance in the use of the tool. Where an individual tooth is badly worn it is good practice to remove the tooth from the holder, grind off-hand to a templet, insert in the body using a dial indicator to insure uniform tooth height and grind as above. Lapping is recommended.

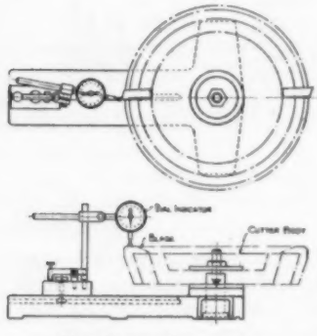
General instructions:

1. Use light feeds and pass the work across the face of the wheel.

2. The tooth height should be checked after grinding with a dial indicator. The face of the teeth should be within 0.0005 in. and the outside diameter within 0.0015 in. The greater the uniformity in tooth height the more efficient the cutter will be.

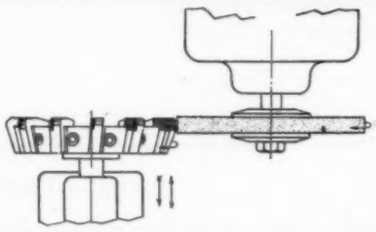
3. Grind frequently enough so that no more than 0.005 in. has to be removed from the teeth. Grinding time increases very rapidly with the amount of stock to be removed.

4. Grind against the cutting edge, holding the cutter firmly against the finger.

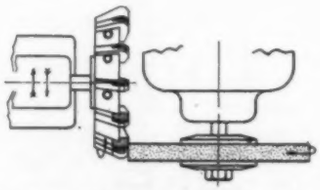


Checking the cutter in a bench fixture

Inserted-Tooth Face Milling Cutters

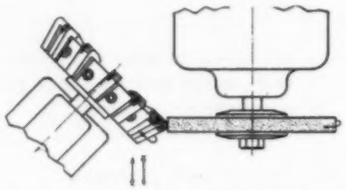


1. Set up cutter on arbor and grind the O.D.



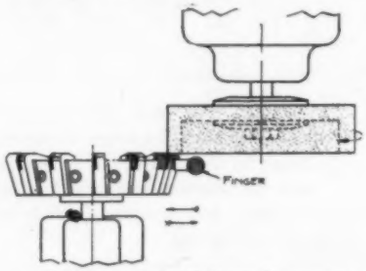
2. Turn wheel head and grind the faces of the teeth.

NOTE: A power driven arbor is recommended for operations 1 and 2 so that the work speed may be held constant, thus insuring uniform tooth height.

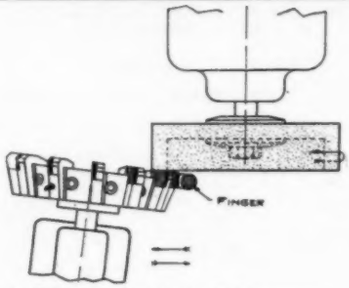


3. Turn wheel head and grind the corners of the teeth; see note below.

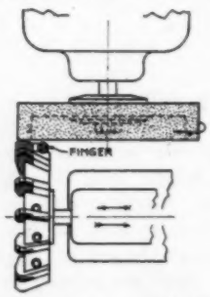
NOTE: Where the grinding equipment does not permit the grinding of a true radius on the corner grind a 45° angle first and then angles of 22½° and 67½°. The resulting corner will approximate a radius.



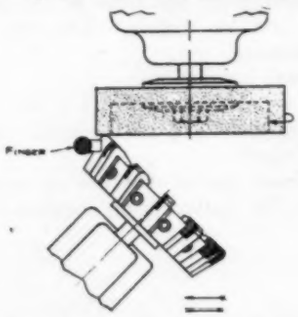
4. Set up cutter and finger for correct angle and back off the face of each tooth with a cup wheel leaving a slight land at the cutting edge.



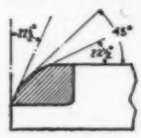
5. Repeat 4 for the heel clearance.



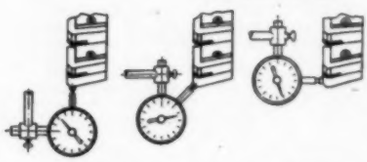
6. Repeat 4 for the outside diameter.



7. Repeat 4 for the corner of each tooth; see note below.



For small radii (under ¼") grind 1 flat at 45° and 2 small flats at 22½° and 67½° by means of suitable adjustments of the tool holder.



8. Check periphery, sides, and corners of each tooth with a dial indicator

Carbide Tools on Non-Ferrous Metals

FRANCIS A. WESTBROOK

RECENT DEVELOPMENTS in boring non-ferrous metals with tungsten-carbide tools have resulted in better finish and a degree of accuracy equal to that obtained by grinding. When single-pointed tungsten-carbide tools are used in machines properly designed for their use, great economies can be realized because of the saving in time and the elimination of spoiled work which they make possible. What has been accomplished in this direction can be most convincingly demonstrated by discussing briefly a few examples taken from actual practice.

In finishing the four bores in the bodies of bronze gasoline meters, it formerly required two minutes to finish bore and two minutes to hone each hole. Also, there was trouble in keeping the holes round and free from taper. Using tungsten-carbide tools in the set-up shown in Fig. 1, it is possible to finish the eight holes in two meter bodies in four minutes, an increase in production of 800 per cent. In addition the honing operation was eliminated.

For the former method selective assembly was necessary in order to turn out meters that were within the government limit of accuracy of 2 cu. in. per gal. at test and 3 cu. in. after installation. With the new method of production, all parts are interchangeable, and an accuracy within 1 cu. in. per gal., plus or minus, for the life of the pump is the regular thing.

Another operation with tungsten-carbide tools is boring the piston-pin holes in aluminum pistons for automotive engines. Since it is necessary to have the piston pins lapped to extremely close tolerances, the holes in which they fit must be correspondingly accurate. With the set-up, shown in Fig. 2, it was possible to bore the holes within a tolerance of 0.0001 in., so that there was no need for selective assembly. In this set-up, the pistons are located from their bored skirts and are aligned by a floating plug. They are clamped over the heads to avoid the distortion which might be caused by clamping pressure. Production is at the rate of 265 per hour.

In the manufacture of refrigerator parts, great economies have been realized in boring and facing the bronze bushings in the compressor heads. This must be done within a tolerance of 0.0002 in. in order to make gas-tight joints. The operation is carried out with that of boring the cast-iron cylinders in one setting, as shown in Fig. 3.

By the use of tungsten-carbide tools it is possible to eliminate grinding the cylinders; also, to eliminate two turret lathe and one face-grinding operations. The savings are large and depend upon the quantity of production. In the case of one production schedule the savings amounted to $8,000 in one year, and this was but a comparatively small operation. It would be difficult to find a better example of moderniza-

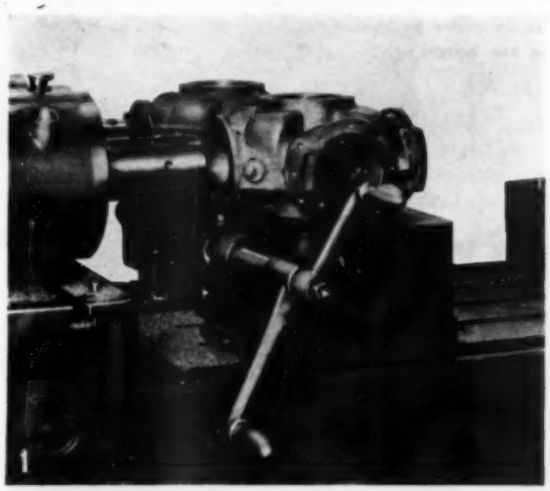


Fig. 1—Eight holes in four meter bodies are bored in four minutes, an increase in production of 800 per cent as compared with former practice

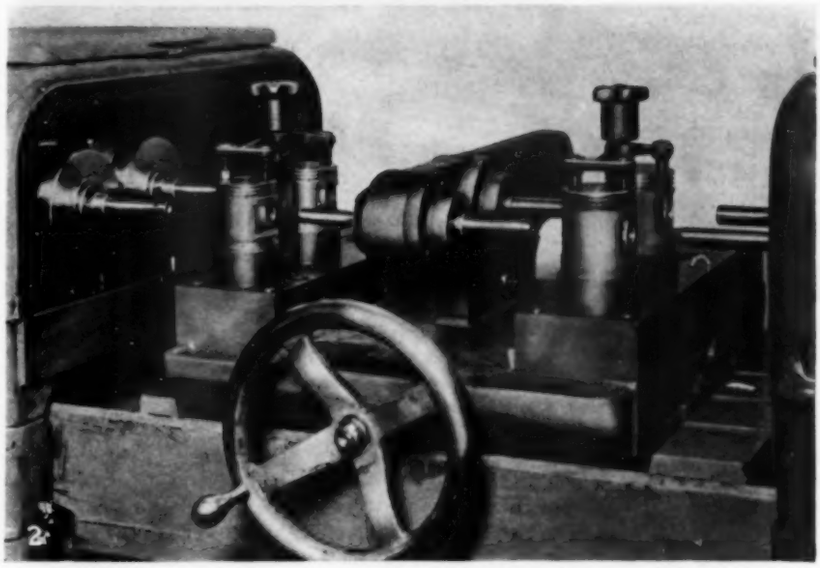


Fig. 2—Holes for piston pins are bored within a tolerance of 0.0001 in., eliminating the necessity for selective assembly. Production is at the rate of 265 per hour

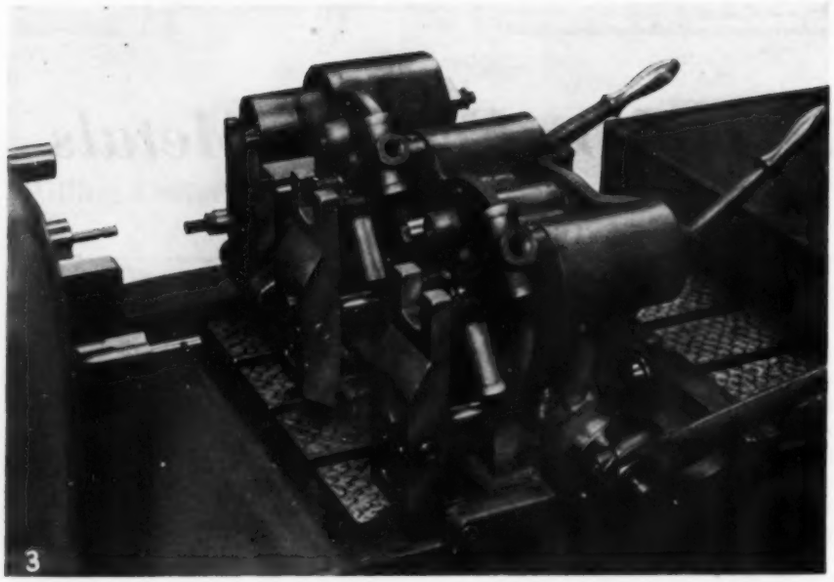


Fig. 3—Bored and faced bushings in compressor heads must be within a tolerance of 0.0002 in. in order to make gas-tight joints. Cast-iron cylinders are bored at the same setting

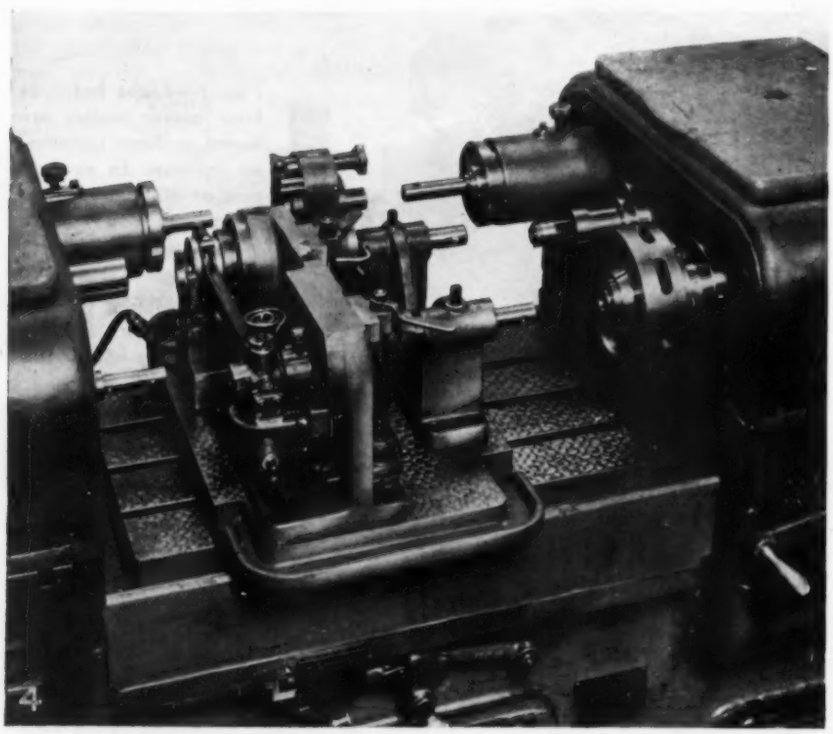


Fig. 4—Boring bronze and babbitt bearings in connecting rods for automotive engines, boring and turning a bronze bushing, and boring two diameters of a cast-iron tappet guide illustrate five operations in three different metals

tion, and it goes without saying that if several details could be handled along such lines the savings would be important.

The set-up shown in Fig. 4 is for boring the bronze and the babbitt bearings in the ends of connecting rods for automotive engines; boring and turning a bronze bushing; and boring the two diameters of a cast-iron tappet guide, all at one setting. In other words, five operations are performed on three different metals at one setting. Tungsten-carbide tools are used for all the operations, which call for extremely close tolerances. This is a good illustration of the versatility of this type of machine and of the ingenious fixtures used. These four examples are sufficient to show that, where modernization is under consideration, it will be well worth while to find out whether or not such tools can be made to fit into the individual program.

Polishing and Buffing Costs—Discussion

K. M. SINGER

Having had a long experience in training polishers, I question the accuracy of John E. Hyler's statement in an article under the title given above (*AM*—Vol. 78, page 641) when he says that the cost of polishing is great. Certainly there are articles the finishing cost of which must be very high, owing to their intricate shapes. Sometimes the shape is the fault of design, the difficulty of finishing having been ignored by the draftsman. More often the trouble is due to the use of unsuitable material, or to the inadequate machining or tool work. But generally the trouble is due to the individual practice of various shops.

After apprenticeship in an engineering shop I thought that I knew something about polishing. Then an experimental stage followed several years later in a toy factory, where it soon became clear that after less than a week's training the average unskilled boy could polish better and faster than could the skilled engineering polisher. Subsequent experience showed that ordinary polishing work could be handled in about one-hundredth part of the time taken in some engineering shops. This may sound incredible, but it has been proved several times in different industries. Two factors contribute mainly to the slowness of the engineering process; custom, which dates back for many decades; and still more, lack of motion study and the lack of provision of the necessary polishing stands, chutes and fixtures.

Mr. Hyler's idea that the future will see much polishing done in automatic machines is hardly practicable, as the design of such machines is extremely difficult. Furthermore, their design would not be justified except on mass production of a valuable component. Much more can be done by using polished materials for the raw object for machining and forging. Cold forging from polished bar and strip stock is a common solution, and the use of the graduated sand blast is not so well developed as it should be.

IDEAS

FROM • PRACTICAL • MEN

Fig. 2—The set-up. The work was mounted on the rotary table of the milling machine and the cutter was held in the vertical milling attachment

An Unusual Milling Job

T. H. ABNEY

The job referred to consisted in milling eighteen circular slots, $\frac{3}{16}$ in. wide, in the valve part illustrated in Fig. 1, the material being S.A.E. 1045 steel. The work was mounted on the rotary table of a milling machine and the vertical attachment was used, as shown in Fig. 2. A plate having raised ribs, Fig. 3, was made to go under the work to raise it up for cutter and chip clearance. The cutter used was a $\frac{3}{16}$-in. end mill of high-speed steel.

Because of the delicacy of the cutter the feed was set at the slowest rate, ¼ in. per min., at the periphery of the table. However, because the diameter of the work was much smaller than that of the table, the feed at the work was but 0.09 in. per min. At each cut the feed was stepped up until the last cut on the outside row was 0.90 in. per min. The feed for the second row of slots was started at 1 in. per min. and was gradually increased to 2.4 in. per min. It then became a question of how much feed the cutter would stand before breaking. In the last row of slots the feed was started at 2 in. per min. and was stepped up for each cut until it was 7.6 in. per min. The cutter did not break even at this feed rate, although it did spring enough to make the finish slightly rough.

Considering that a fair finish was desirable, we found that the best feed was between 5 and 6 in. per min. The speed of the cutter at all the cuts was 1,560 r.p.m. The coolant used was a regular coolant oil. It kept the cutter cool and was heavy enough to carry the fine chips from under the work and between the ribs of the raising plate.

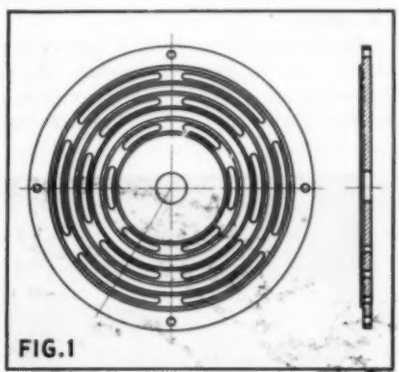


Fig. 1—The work, showing the eighteen circular slots milled in S.A.E. 1045 steel. The maximum feed was 7.6 in. per min. at a cutter speed of 1,560 r.p.m.

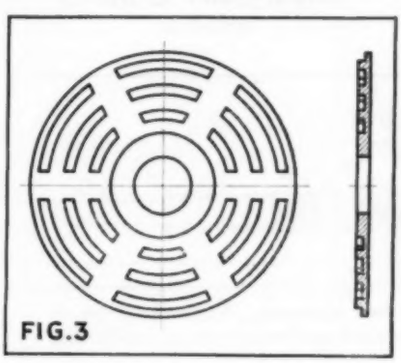


Fig. 3—The plate on which the work rested. Raised ribs permit clearance for the cutter and channels for the coolant to carry away the chips

Inside Micrometer for Measuring a Recess

WM. C. BETZ
Equipment Engineer,
Fafnir Bearing Company

In boring a quantity of castings such as the one illustrated in Fig. 1, we were confronted with the problem of measuring the diameter of the recess *A*. Whatever instrument was to be used must be entered through one of the end holes and in no case could it be longer than dimension *B*. There were several sizes of the castings and in some the dimension *B* was 2 in. less than the diameter of the recess, so that the instrument to be used must be collapsible.

We used a standard micrometer head to which we fitted a spring case and a shouldered measuring rod, as shown in Fig. 2. A measuring rod was made for each size of casting and its length

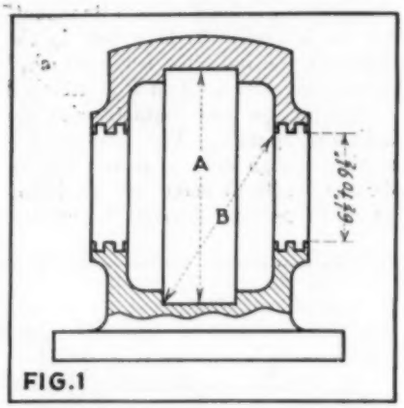


Fig. 1—An instrument to measure the diameter of recess *A* must be entered through one of the end holes and it must not be longer than dimension *B*

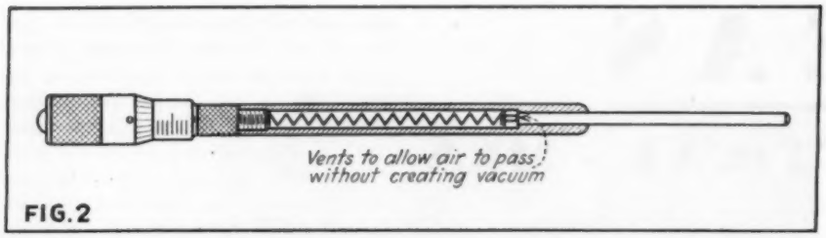


Fig. 2—This collapsible inside micrometer was entered into the recess through one of the end holes and the measuring rod was forced out to its shoulder by the spring

was such that when it was fully extended and the micrometer read ½ in., the overall length of the instrument was equal to the diameter of the recess.

In use, the measuring rod was pushed in the spring case and the instrument was entered into the recess through one of the end holes. On letting go of the meauring rod the spring pushed it out to the shoulder and the measurement was then made in the usual way. By pushing the measuring rod into the spring case, the instrument was short enough to be withdrawn. The measurement was then read on the micrometer head, taking into account that the ½-in. setting represented zero.

Pin Gage Equipped With a Dial Indicator

JOHN A. LANG

The pin gage illustrated consists essentially of the steel tube *A;* the plunger *B;* the stationary rod *C;* the dial indicator *D;* the arm *F;* the spring *H;* and the clamping nut *J.*

A platform of cold-rolled steel is welded to the tube to serve as a base for the dial indicator. The back of the indicator is faced off and its mounting lug is turned to fit a hole in the platform, the indicator being attached thereto by screws. Arm *F* is attached to the plunger and contacts with the indicator spindle. The plunger has motion enough only to permit the indicator needle to make one revolution so as to prevent damage by careless handling. The stationary rod can be adjusted by loosening the clamping nut and screwing the rod in or out of the tube.

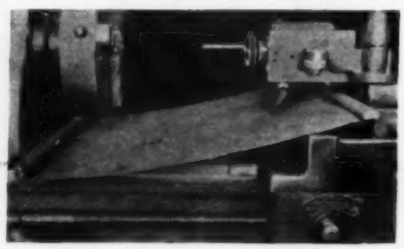
A gage of this type equipped with rods and plungers of various lengths will take care of many different jobs, each of which would otherwise require the use of one or more plain pin gages for accurate machining.

Protecting Lathe Ways in Internal Grinding

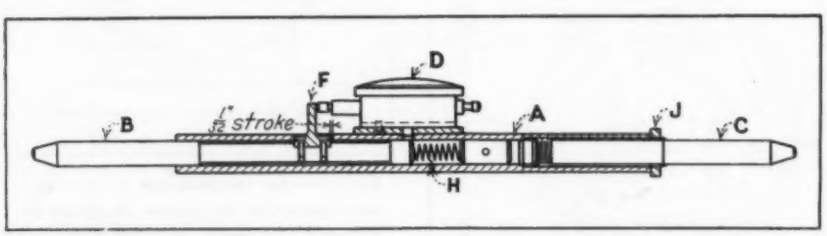
H. J. CHAMBERLAND

If it is necessary to do internal grinding in the lathe, using a toolpost grinder, care should be taken to protect the ways from abrasive dust from the wheel.

One of the better ways of protection is to use a narrow window shade mounted on a spring roller, as shown in the illustration. The brackets for the roller are mounted on a strip of steel attached to the headstock. The free end of the shade is attached to the carriage by any suitable means. With the shade in place it will roll and unroll as the carriage travels back and forth, catching the abrasive dust that would otherwise fall on the ways.



A window shade mounted as shown will protect the ways of the lathe from abrasive dust when using the toolpost grinder for internal grinding



Gages of this type are both sensitive and accurate. Their use, even in unskilled hands, has resulted in better work and lower costs of machining

Lubrication in Deep Drilling

MALCOLM K. PARKHURST

In drilling comparatively deep holes in work in the lathe, getting lubricant to the point of the drill is always something of a problem. However, it was solved by the use of a positive-pressure oil can of the type illustrated. The "shooting" properties of a can of this type are a little short of amazing. Shooting a stream of oil from twelve to fifteen feet is possible by giving the trigger a sharp pull.

To adapt the can to the type of work referred to, the tip of the spout was bent at nearly a right angle, as shown. The bending should be carefully done as, like most oil cans, the spout is not made from seamless stock and the seam at the bend may be opened in bending. If so, the opening can be soldered. The tip of the spout nearly fits in the flute of the drill, so that all that is necessary is to back out the drill far enough for the stream of oil to wash out the chips from the bottom of the hole. Pressure oilers of this type can be bought at almost any hardware store carrying mill supplies.

By giving the trigger of this oil can a sharp pull, oil can be squirted with enough pressure to wash the chips from a comparatively deep hole

Gage for Checking Bores

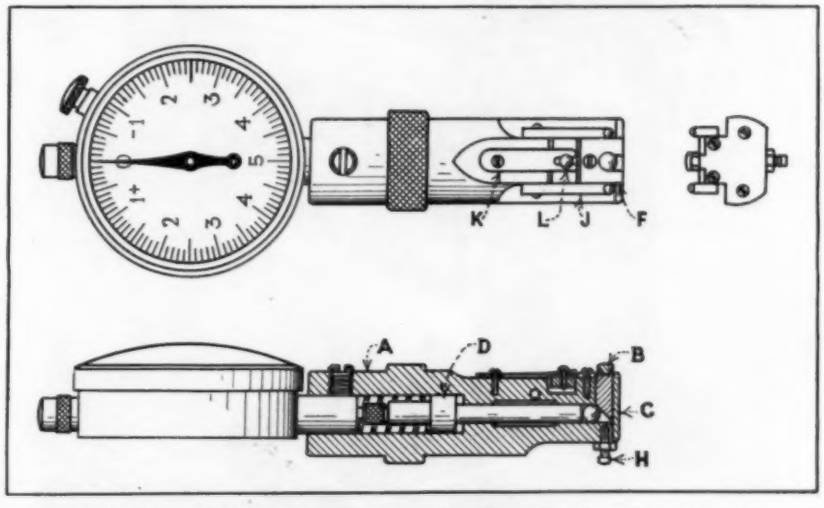
J. H. BOULET, JR.
General Household Utilities Company
Gage Division

The gage illustrated was designed for checking the bores of bushings for diameter, taper and out of roundness. As the bushings were quite long it was desirable to have the gage reach 2¾ in. into the bores.

The body *A* is bronze and holds a dial indicator reading to 0.0001 in. and contains the movable members by which the indicator is operated. A flat on the side of gaging pin *B* bears on the plate *C* and prevents the pin from turning. The inner end of the gaging pin is at an angle of 45 deg. and interposed between it and the lower end of plunger *D* is a steel ball. When the gaging pin moves, motion of the same amount is transmitted to the plunger through the steel ball. Thus the ratio of movement is 1 to 1. The gaging pin is tipped with tungsten-carbide to resist wear and is retained in the body by the small plate *F*. Diametrically opposite the gaging pin and in the same plane is the adjustable anvil *H*, also tipped with tungsten-carbide.

The lower end of plunger *D* is kept in contact with the steel ball by a helical spring, and its upper end is in contact with the spindle of the dial indicator. Thus, when the plunger is moved by the gaging pin, the amount of its motion is registered by the indicator needle. At *J* is a pivoted lever in the shape of an inverted U, having contact buttons near the lower ends of both legs. These buttons are in the same horizontal plane as is the gaging pin and are equi-distant from it. The lever is kept in the outward position by the flat spring *K*, its movement being limited by the head of pin *L*. The object of this lever is to aid in centering the gaging pin in the bore being checked.

In setting the gage, a master ring gage is used, the dial being set to zero. Since the gage is used for internal checking, the plus and minus movements of the indicator needle are in the opposite directions from those in external checking. That is, when the bore being checked is too large, the needle moves in the minus direction, and when the bore is too small it moves in the plus direction. To guard against errors in reading the direction of variation, the plus and minus signs are marked on their correct sides of zero on the dial. Four of these gages have been in use for nearly a year and have been found very accurate.

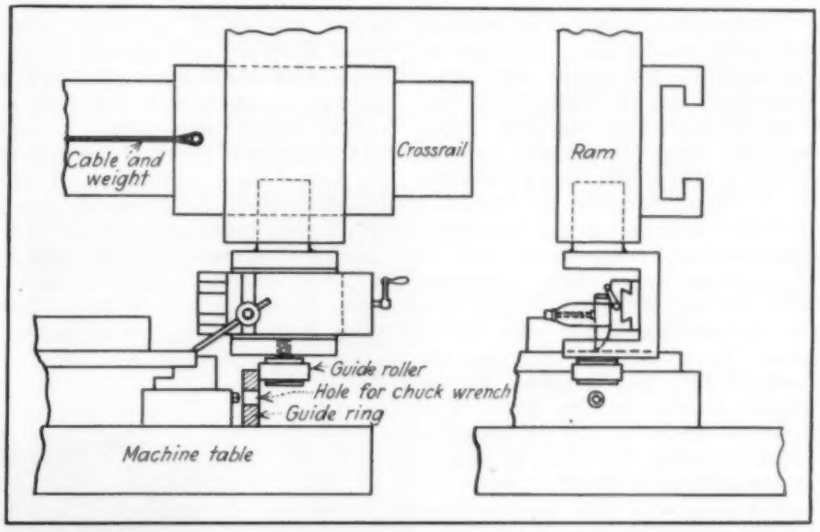


For checking the bores in comparatively long bushings for diameter, taper and out of roundness, gages of this type have been found very accurate

Facing Elliptical Work

WILLIAM C. ELLIS

We had to machine the joint faces of a lot of 12- x 6-in. elliptical manhole covers in which a raised rib made it necessary for the tool to travel in an elliptical path. The job was done in a vertical boring mill, the work being held by independent chuck jaws on the table. A guide ring larger than the work, but of the same shape, was attached to the table outside of the chuck jaws. The compound rest from a lathe was attached to an offset bracket fastened to the bottom of the ram, and on the under side of the bracket was a stud carrying a hardened steel roller. With the nut in the saddle disengaged from the feed screw in the crossrail, a cable was attached to the saddle and run over a pulley at the end of the crossrail. A weight on the free end of the cable kept the tool in contact with the outside of the guide ring, so that the tool followed an elliptical path; all as shown in the illustration.



With the saddle disengaged from the feed screw, a weight attached to a cable kept the roller in contact with the guide ring and caused the tool to follow an elliptical path

The tool was fed by hand and the depth of cut was regulated by vertical adjustment of the ram. The device worked successfully and gave us the satisfaction of having gotten away with a rather difficult job.

SHOP EQUIPMENT NEWS

Brown & Sharpe No. 2 Plain Milling Machine

Contrary to the trend of the machine tool design during recent years toward increased size and weight with added horsepower and multiplicity of controls, the No. 2 light-type plain milling machine being introduced by the Brown & Sharpe Mfg. Co., Providence, R. I., might properly be termed a simplified machine. It is a completely self-contained, motor-driven unit, a flanged-type motor being employed with the motor pinion meshing with the internal gear of the main driving shaft. The motor runs only when the machine runs and is started by the regular machine starting lever. This lever also serves to aply the brake for quick stopping. All wiring is inclosed in a compartment directly beneath the motor where it is fully protected, yet readily accessible. Motors can be supplied for usual voltages, alternating or direct current.

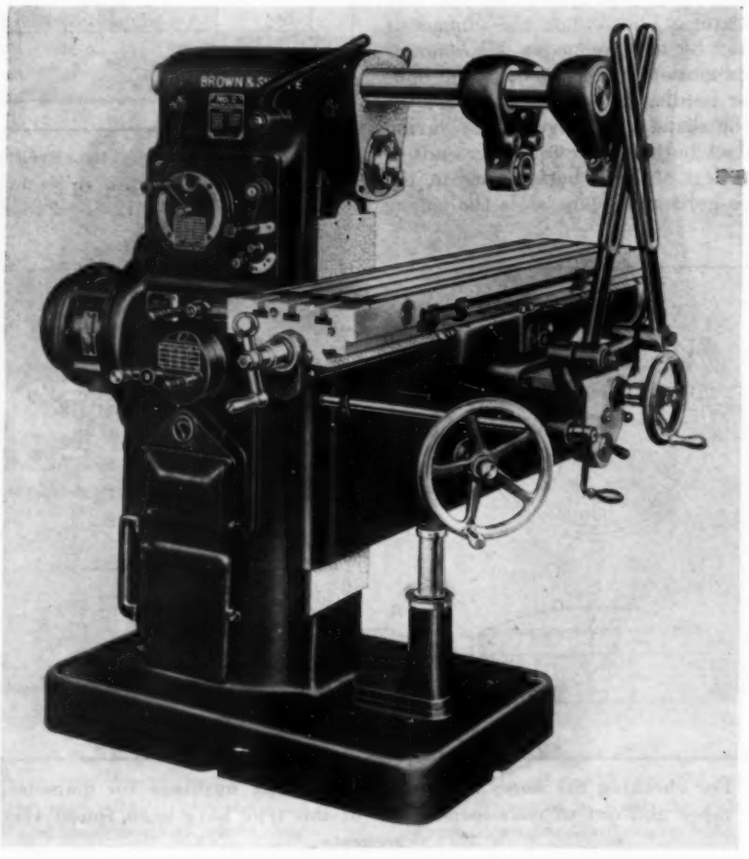
Spindle height has been lowered to give a more convenient height for vision of cuters and work by the operator. The correspondingly lower height of the table brings about easier handling, thus improving general operating efficiency.

A wide range of speeds has been provided to meet a variety of requirements, the speeds being arranged in two series, giving 16 spindle speeds from 40 to 1,300 r.p.m. Changes are made by a convenient rotating lever on the side of the column in conjuction with a backgear and high- and low-series lever, one-quarter revolution of the rotating lever giving a change in speed in the series engaged. A convenient single lever feed control is also provided for the 16 feed changes from ½ to 18¼ in. per min., one revolution of the lever giving a change of feed rate. All feeds can be disengaged by placing the feed lever in "locked" position, thus preventing accidental engagement of feeds when power feeds are not required. Directional longitudinal feed engagement is provided on the front of the table, in addition to the transverse and vertical feed engagement levers on the side of the knee. Hand adjustmens are obtained by the usual hand-wheels and cranks with quick return of table obtained by an internal gear and pinion. A change from the conventional design of column has been made by the face on which the knee rests, being set back approximately 4 in. from the end of the spindle. Not only does this give added clearance for vises, fixtures and work, especially when using end mills, but also permits cutters to be set nearer to the spindle nose.

Ground tooth gears are used throughout in the speed train. Regardless of the speed engaged the spindle drive is always through the spindle gear mounted on the spindle, directly behind the front bearings and driven through six integral splines. The driving shafts in the column are splined and mounted on anti-friction bearings. All mechanism within the column is lubricated by a pressure oiling system.

While the coolant system is furnished as extra equipment, the base of the machine is made with a tank for holding cutter coolant when the system is installed. The machine is arranged to take a compact, individual motor driven centrifugal coolant pump, so arranged that it operates only when the machine is running.

An improved degree of convenience and operating efficiency has been added by the use of the universal milling attachment with a crane, furnished as an extra, which permits the attachment to be swung to the side of the



machine when not in use, yet instantly available. The wide range of adjustment of the attachment, together with the speed range from 82 to 2,672 r.p.m., provides a means of handling a great variety of work. Another feature is the provision for obtaining short leads and fine feeds by the use of a reducing attachment, furnished as an extra, which is driven from the table feed screw.

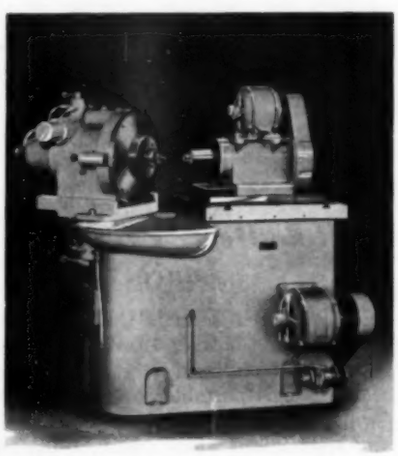
Capacity of the machine is longitudinal feed, 28 in.; traverse feed, 10 in., and vertical feed, 15 in., all automatic. Net weight is approximately 2,400 lb., including a 3-hp. motor.

Cross Gear-Tooth Finishing Machines

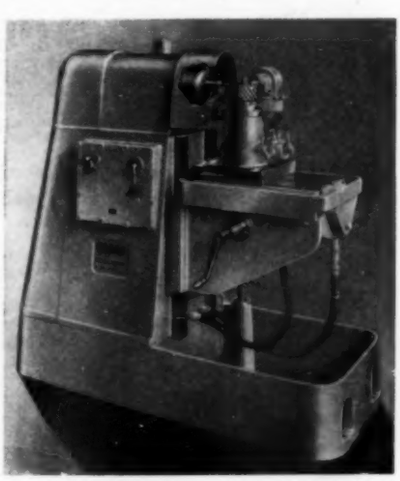
Three machines have been developed by the Cross Gear & Machine Co., 3250 Bellevue Ave., Detroit, Mich., for performing various rounding, pointing, chamfering and burring operations on all gears. The No. 35 gear tooth rounder is fully hydraulically controlled and operated. Hydraulic prime movers actuate the mechanisms which were formerly cam controlled. The automatic indexing mechanism is completely universal throughout the entire range of the machine. The head of the machine is a self-contained unit composed of the spindle, the rack which actuates the spindle and the sector which locates and firmly holds the gear tooth while it is being rounded. Indexing is accomplished from the already formed tooth of the gear by means of a hydraulically actuated pawl. The motor drive is housed in the column of the machine and power transmission is accomplished by means of multiple V-belts. Specifications: gear face capacity, 15 in.; gear diameter capacity 36 in.; gear pitch capacity, 2 pitch or finer.

The No. 40 gear tooth pointing machine is a semi-single-purpose tool which employs a hollow mill type of cutter that is moved into the work which is held stationary. Automatic indexing, hydraulically controlled, is accurate within 0.0001 in. A hardened steel taper plug locates the dividing plate by registering in a hardened steel taper bushing. The dividing head is a self-contained unit designed for maximum rigidity, accuracy and long life. The ball bearing gibs, on which the table is mounted, are adjustable and replaceable. Specifications: gear face capacity, 12 in.; gear diameter capacity, 20 in.; gear pitch capacity, 2 pitch or finer.

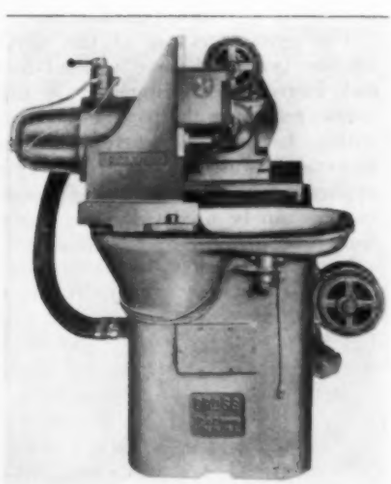
The cutter spindle of the No. 50 gear-tooth chamfering machine remains fixed while the work spindle is movable and the work is presented to the cutter. While the gear is being rotated, the work-holding spindle is moved forward and back with a guide cam mounted at the side of the head assembly. The work spindle is independently driven by a hydraulic motor. A hydraulic cylinder keeps the cam follower firmly against the cam. Another hydraulic cylinder is used to hold the indexing gear firmly in mesh with the work during the cutting operation. The work head is mounted directly onto the box unit base of the machine. Base of the work head serves as a dial and is graduated to facilitate setting up operations. The oil valves and the hydraulic pump are confined to one compartment in the base, minimizing the possibility of leakage. Drive is obtained through electric motors and multiple V-belts. Specifications: gear face capacity, 15 in.; gear diameter capacity, 20 in.; gear pitch capacity, 2 pitch or finer. The No. 40 and No. 50 machines are also available in two-spindle, two-station types.



Cross No. 40 Gear-Tooth Pointer



Cross No. 35 Gear-Tooth Rounder

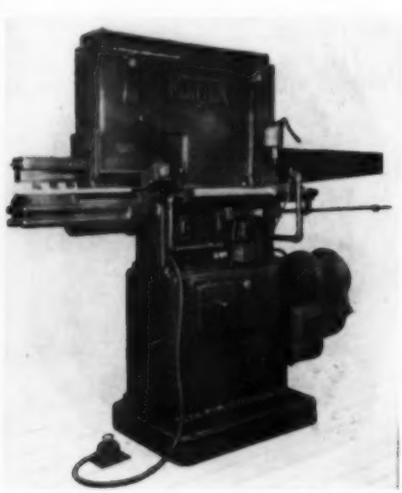


Cross No. 50 Gear-Tooth Chamfering Machine

Morton Flash Trimming Machine

This draw-cut, flash-trimming machine built by the Morton Manufacturing Co., Muskegon Heights, Mich., is especially designed for removing the flash from butt-welded steel rings, such as automobile wheel rims. It will take a width of seam up to 12 in. and stock thicknesses from 24 gage to $\frac{3}{8}$ in. Power is supplied by an electric motor driving a hydraulic pump. The machine has a variable and return speed from 0 to 65 ft. per min.

Two reciprocating rams are operated by means of hydraulic cylinders. The



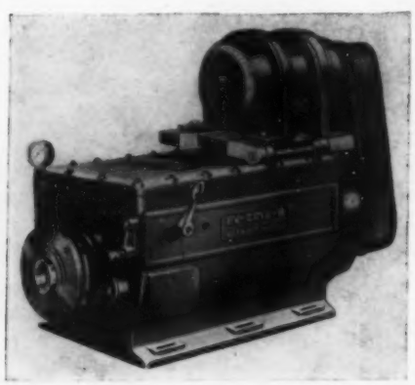
work is placed between hardened dies and clamped through a hydraulically operated, spring-loaded toggle motion. Vertically adjustable ram and dies are employed and compensate for any variation in stock thickness. The upper ram raises 2 in., giving sufficient clearance for entering and removing the work. The cycle of operation is automatic. As the work is entered, the operator steps on the button, the machine automatically clamps the work, starts its cut on the draw-cut stroke, releases the work at the end of the stroke, and the cutting tools return to the out position. The distance from the clamping die to the floor is 55 in. This may be varied to meet requirements.

Ex-Cell-O Hydraulic Power Unit

The hydraulic power unit manufactured by the Ex-Cell-O Aircraft & Tool Corp., 1200 Oakman Blvd., Detroit, Mich., is available in three sizes. The small unit, No. 23, has an 8-in. stroke; the medium, No. 25, has a 10-in. stroke, and the large, No. 28, has a 12-in. stroke. These units are adjustable for length of stroke, length of rapid traverse and length of feed.

An electric motor is mounted on an adjustable base located above the unit. It drives the hydraulic pump and drive shaft by V-belts. The pump driving shaft is connected through change gears to the spindle driving shaft which at the inner end is splined and forms a sliding driver connection with the spindle. The spindle is supported at both front and rear ends in the main quill which carries a piston that is hydraulically operated by changing pressure at either end of the piston. The main quill or ram moves either forward or backward providing the feed for the unit.

The ram of the hydraulic unit is furnished with a mounting flange for attaching multiple-spindle heads. A machined pad is provided on each side of the unit for attaching guide bar brackets for multiple heads or jig plates.



"Duralite" No. 50 Hot Workers Goggle

The "Duralite-50" hot workers' goggle announced by the American Optical Co., Southbridge, Mass., in intended for use in confined spaces or where the humidity is high. This goggle practically doubles the area usually allowed for ventilation. The extra ventilation

in back of the lenses keeps them free from fogging and steaming and also keeps the area around the eyes cool and so prevents perspiration from obscuring the vision. The goggles are provided with Super Armorplate lenses.

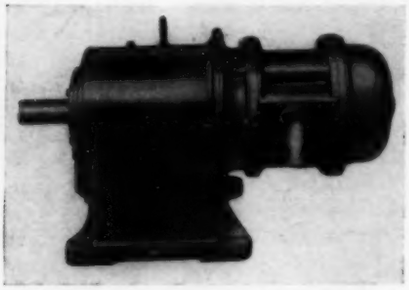
"Hold-Heet" Pyrometer Lance

The Russell Electric Co., 352 West Huron St., Chicago, Ill., has recently announced a "Hold Heet" pyrometer lance. This portable hand instrument will serve for checking temperatures in all applications where wall-type pyrometers are used. It may be used as a "trouble-shooter" and as a check tester in existing pyrometer installations.

The pyrometers are of the direct-reading type and have manual cold-end correction adjustment. A high meter resistance keeps the accuracy within 1 per cent where the same movement is used in a wide variety of applications. Heavy rigid thermocouples can be used without a protection tube in most applications.

Link-Belt Motorized Reducers

An outstanding feature of the line of motorized helical-gear reducers announced by the Link-Belt Co., Chicago, Ill., is the accessibility of the motor and the high-speed gears. A standard round-frame motor is secured to the side of the reducer housing by means of an adapter casting which supports the motor shaft, assuring alignment and proper mesh of the pinion with its mate. The complete motor, with adapter and motor pinion, may be removed as a unit for inspection and maintenance, without disturbing the alignment of the motor, or of the gears remaining in the re-

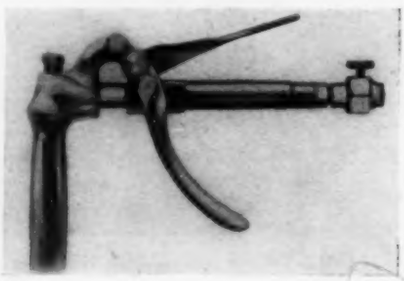


ducer housing. The low-speed shaft and its bearings are designed to carry overhung loads. These motorized reducers may be mounted on floor, ceiling or wall, and are available in double reduction for ½ to 75 hp. in ratios up to 38½ to 1, and in triple reduction up to 30 hp. in ratios up to 292 to 1.

Triple "S" Gun-Head Control Valve

The Triple "S" gun-head control valve, put out by the Specialty Sales Service Corp., 138 Holden St., Minneapolis, Minn., operates on any grease line presure of from 50 to 5,000 lb. It has been designed for use on all types of pressure systems and power operated grease guns, barrel pumps and 100-lb. drum pumps.

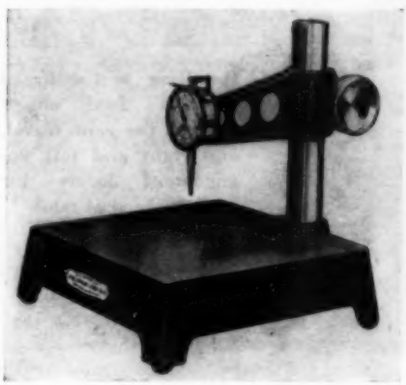
In such applications in the past, the practice has been to develop and main-



tain a line pressure of approximately 3,000 lb. The Triple S "Lo-Hi" method of lubrication advocates a low line pressure of 100 to 1,000 lb. with the Triple S gun head control valve at the end of a high pressure hose, with which, by easy and rapid stages, the pressure can be stepped up to in excess of 20,000 lb. when required on badly clogged bearings.

Ames Upright Dial Gage

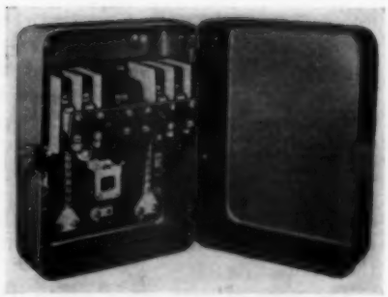
The upright dial gage No. 13, made by the B. C. Ames Co., Waltham, Mass., has been made to support the dial more rigidly and to provide a quick and positive clamping of the bracket to the upright column. The cast-iron base with ground top surface 8x8 in. supports an upright steel column that is 1¼ in. in diameter and extends 9⅞ in. above the base. A slight turn of the large-diameter binding screw

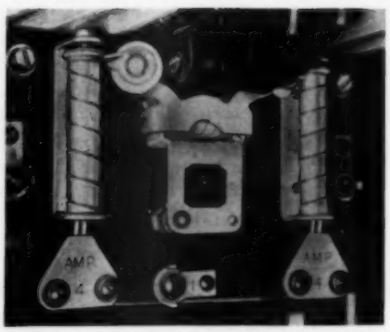


securely fastens the bracket and gage to the column. The gage regularly supplied is 2½ in. diameter, has a movable dial graduated 0-50-0 to indicate thousandths inches, and a small hand to indicate the number of revolutions made by the large hand. The spindle is raised ⅛ in. by pressing down the lever at the left of the dial. Other Ames gages may be used with this improved mounting. Over-all height is 11⅞ in., and net weight is 16½ lb.

Monitor A. C. Motor Starter

This starter, built by the Monitor Controller Co., 51 S. Gay St., Baltimore, Md., is intended for use with squirrel-cage motors or as a primary contactor for wound-rotor motors in conjunction with suitable secondary rheostats. Standard features of design include: Automatic reset overload; manual reset overload operative from





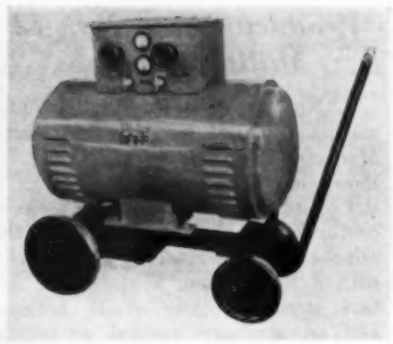
Lower view—Replaceable heater elements permit changing the relay's capacity

a button in the cover; start and stop push button in the cover; hand-off-automatic switch and reset button, fusible or unfused disconnect switch.

The thermal overload relay which is an integral part of all starters is so compensated that wide variations in ambient temperatures do not affect its operating characteristics. A close-up of this relay is illustrated. The rating of the relay can be quickly changed by inserting the proper heater elements to handle any load condition within the range of the starter. Contactors of all ratings are capable of breaking stalled-rotor current. The contacts are protected with barriers which prevent flashover between phases. Inclosures are of pressed steel for general purpose applications, and cast iron for dust-tight and water-tight applications.

Noel "Speed Arc" Improved Welder

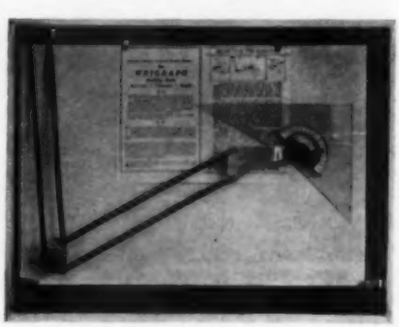
The Ideal Electric & Manufacturing Co., Mansfield, Ohio, announces the development of an arc welder featuring unity power-factor motor drive, 10 to 15 per cent better over-all efficiency, and an extremely fast arc. An arrangement of generator windings utilizing a separate auxiliary differential field structure produces improvement in welding performance. The unit will maintain its current and voltage settings when started up cold and run full load for any period.



Noel welders provide both 25- and 40-volt operation. This permits the use of the improved high-speed coated rods, as well as standard uncoated rods. Other features included in "Noel Arc" welders are: dual control system for both voltage and current control, polarity reversing switch and zero center individual current and voltage meters. When the pulling handle is lifted, an automatic brake holds the welder from rolling. These welders are also available for d.c. motor drive and engine drive.

"Wrigraph" Drafting Blocks

Combining a drawing board and a drafting machine, this instrument announced by the L. G. Wright Co., 5713 Euclid Ave., Cleveland, Ohio, is made in three sizes. The illustration shows the Model A size, 18x24 in. board and protractor triangle. The Model B has a 12x18 in. board; the junior is a complete unit with board size 10x12 in. The board is made of ¼ in. black Presdwood and is equipped with clips which hold either a single sheet or a pad of paper. No thumb tacks are required. The triangle attachment gives angles of 15, 30, 45, 60 and 90 deg. without reference to the protractor. The right-angle sides are graduated to ⅛ or 1/10 in. Interchangeable attachments on the parallel device make it possible for the technical man to purchase only that part of the equipment he requires.



Producto-Matic No. 42 Milling Machine

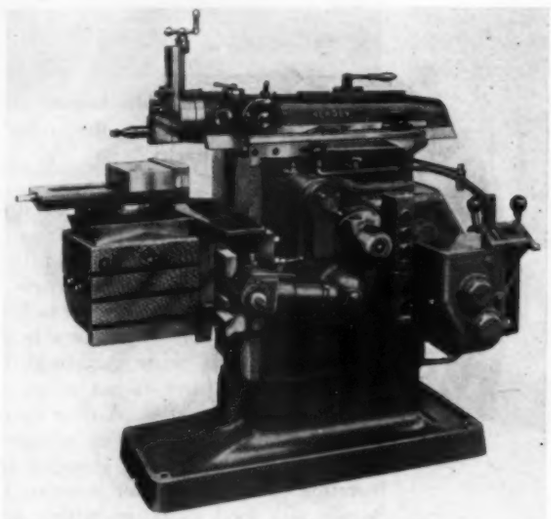
A No. 42 Producto-Matic milling machine made by the Producto Machine Co., Bridgeport, Conn., is shown in Fig. 1 set up for milling a slot ⅛-in. wide in the end of a piece of cold-rolled steel and chamfering the same end. The machine is equipped with a four-station, work-holding fixture, standard cutter spindle bearing, and an auxiliary vertical six-spindle head at right angles to the milling cutters. Each station of the work fixture holds six pieces in line. The work is held against a pair of V-jaws, and the outer end is clamped by means of equalizers. One lever opens and closes the equalizers for convenience in unloading. The lower part of the fixture can be moved laterally by means of a handle, thus allowing the pieces to drop out of place without effort on the part of the operator. The whole cutter spindle assembly makes vertical travel only. In the auxiliary spindle hollow mills are used, but drills, reamers or counterbores could be used just as well. Coolant is sent through the center of the chamfering spindle. Both cutter drives are from the one center driving unit of the machine. Production is 1,200 to 1,400 pieces per hour. A 7½-hp. motor is used, and the approximate weight of the machine is 8,000 lb.

In another setup, Fig. 2, the No. 42 machine is shown arranged with double cutter spindles, with the spindles in tandem on 3 in. centers. It is equipped with a two-station work-holding fixture to permit one station to be in the loading and one in the milling position. The fixture is designed to hold twelve pieces of work in each station. Cutters on the front arbor mill two pieces in each of three lines, and at the same time the cutters on the rear arbor mill two pieces in each of the three lines. An air cylinder in each station, operated by a single lever, controls the three toggle-action levers which clamp the work.

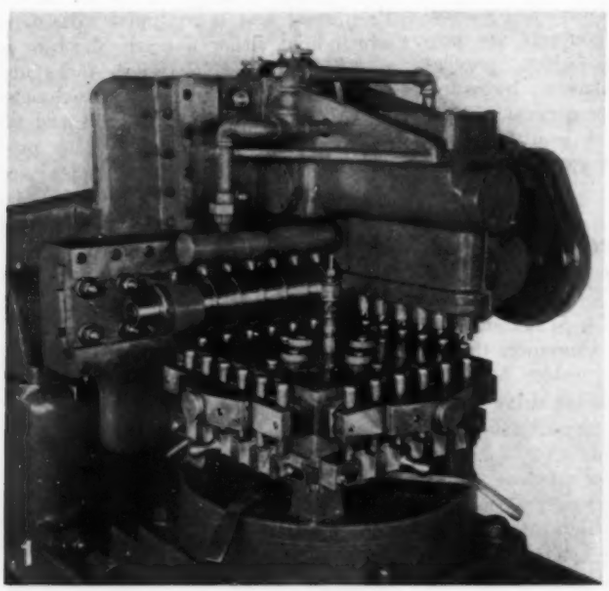
The piece of work being milled is a threaded stud 3¼ in. long by ⅞ in. diameter. A flat ½ in. wide and ⅞ in. deep is milled on one side in the center of the piece. Provision is made within the fixture to indicate each of the twelve pieces from a slot produced in a previous operation, so that the flat and the slot are at right angles to each other. Production, 1,200 pieces per hr.

Hendey 12-In. Crank Shaper

The 12-in. crank shaper manufactured by the Hendey Machine Co., Torrington, Conn., is a high-speed cutting tool. On a 6-in. stroke it has a maximum cutting speed of 182 ft. per min., and on a 12-in. stroke a high cutting speed of 120 ft. per min. It is through the use of light weight alloy material of high physical properties in the ram, rocker arm and head castings that the effective reciprocations of ram travel in the high speeds are secured and maintained without disturbing the equilibrium of the machine. For forming tool cuts and other work of heavy duty there is also an ample range of slower speeds, the minimum being 23



Handling is facilitated through dual clutch control for ram travel, and right and left engagement levers for cross-feed of table



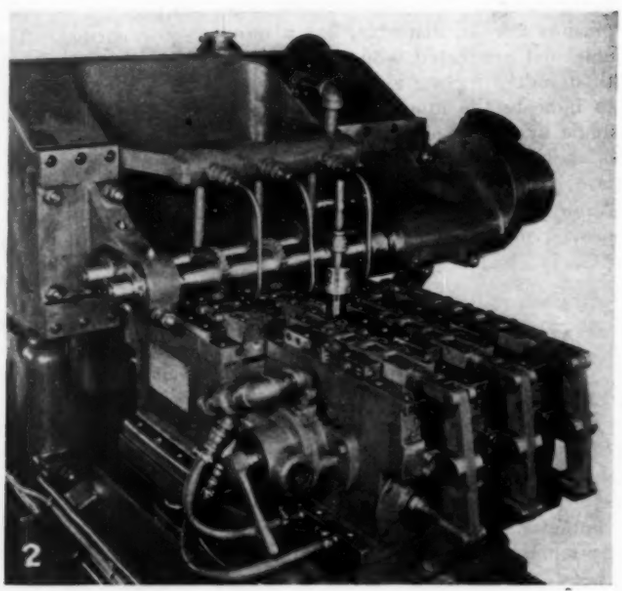


Fig. 1—Producto-Matic No. 42 Milling Machine set up for milling a slot in the end of a steel bar and chamfering the end simultaneously. Fig. 2—Same machine arranged to mill a flat on the side of bar stock

ft. per min. on 12-in. stroke and 45 ft. per min. on 2-in. stroke.

The speed changing mechanism is of unit construction. The complete assembly includes the speed gearbox with shafts and gearing, also backgears and pinion driving the crank gear. Eight geared speeds are provided for ram travel, four direct through the backgear. These changes give a range of from 14 to 200 strokes per min. The entire driving mechanism is automatically lubricated. Drive is by an a.c. or d.c., gear-reduction type, 2-hp. motor. Specifications: Length of ram, 34 in.; length of stroke, 12¾ in.; power down feed range, 0.0024 to 0.030 in.; net weight, 2,700 lb.

Simplex Abrasive Band Grinder

The features of the Simplex-M-6 abrasive band grinder, offered by the Walls Sales Corp., 96 Warren St., New York, N. Y., are the instantaneous changeability and fixed running position of the abrasive band and the automatic band tension. When the lever in the center is pulled out, the loose band pulley is drawn in and the tension is released, allowing the abrasive band to be removed and changed for another operation while the grinder is running.

The Simplex-M-6 is of the pedestal type and equipped with a ¾-hp. fully inclosed motor with roller chain drive. It is built for production work, running at 1,900 ft. per min. The machine weight is 425 lb.

Onsrud Air Turbine Grinder

An air turbine grinder, known as the MD-1, manufactured by the Onsrud Machine Works, Inc., 3900 Palmer St., Chicago, Ill., develops ¼ hp. and 50,000 r.p.m. on usual factory air pressure and weighs but 1 lb. 15 oz. It operates with no vibration and very little gyroscopic action. Trouble from over-

heating is not experienced because of the cooling action of the expanded exhaust air. The grinder is particularly adaptable for die grinding, milling and internal grinding. A toolpost holder is available so that it may be mounted in a vise or lathe.

Automatic lubrication is obtained by centrifugal force feed. The chambered spindle holds sufficient oil for at least one week of normal use. The housing is of duralumin, the rotor is aluminum bronze, the spindle nickel steel, heat-treated, ground and balanced.

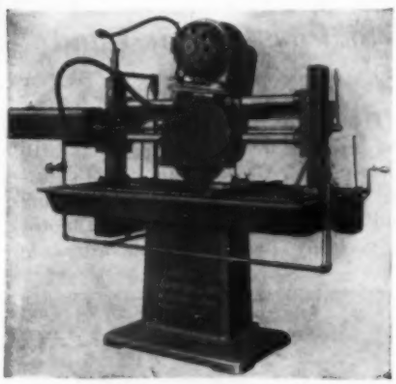
Porter-Cable Belt Grinder

The Type B-12 belt grinder, put out by the Porter-Cable Machine Co., Syracuse, N. Y., can be used for grinding off burrs, smoothing off rough stampings, smoothing down weld spots, and

all other small-parts grinding operations. A flat, even surface with clean, sharp edges is assured by reason of the flat metal bed over which the abrasive belt travels. Any speed up to 4,000 ft. per min. can be had by attaching the proper ratio pulley to the drive shaft. Motors of ½ or ¾ hp. may be used on the motor base supplied. The length and width overall are 34 and 11½ in., respectively. The weight of the grinder without motor is 125 lb.

Campbell Model 302 Abrasive Cutting Machine

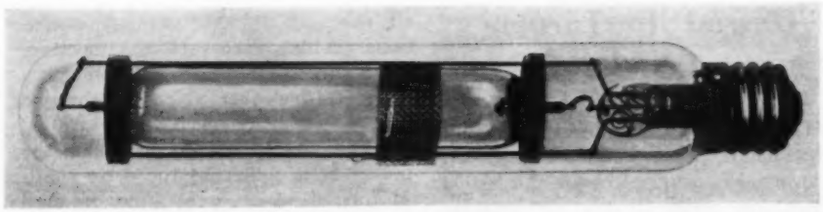
The Model 302 horizontal wet abrasive cutting machine is an addition to the line of cutting off machines made by Andrew C. Campbell Division of American Chain Co., Inc., Bridgeport, Conn. This machine was designed primarily for making long cuts through



flat or slab stock, but bar stock can also be cut. Hydraulic feed mechanism permits the abrasive cutting of larger size of flat material than has heretofore been considered practical. This hydraulic feed can be regulated for rate of feed with infinite variations. Cutting is done by revolving a thin abrasive disk to which is applied a continuous stream of coolant. Danger to workmen because of dust-laden air is eliminated. Steel, copper, cast iron, and alloys can be cut off.

General Electric Mercury Vapor Lamp

The General Electric Vapor Lamp Co., Hoboken, N. J., has perfected a high-intensity mercury vapor lamp which is particularly suitable for high bay lighting. It is an approach to white light which is restful to the eye, which enables quick visual response even to details. It promotes the continued use of the eyes without fatigue.



Offered for high-bay lighting this mercury vapor lamp gives a restful "white" light and has a life of 1500 hr.

The lamp is particularly efficient in that it produces 14,000 lumens at a consumption of 400 watts, or approximately 35 lumens per watt. It is made with a Mogul screw base for vertical mounting. From a technical standpoint the light is not white. It is a combination of blue light and yellow-green which produces a whiter sensation to the observer. Overall length is 13 in. and the lamp is designed for operation on 110 and 220 volts, 60 cycle circuit. It has an average life of 1500 hours.

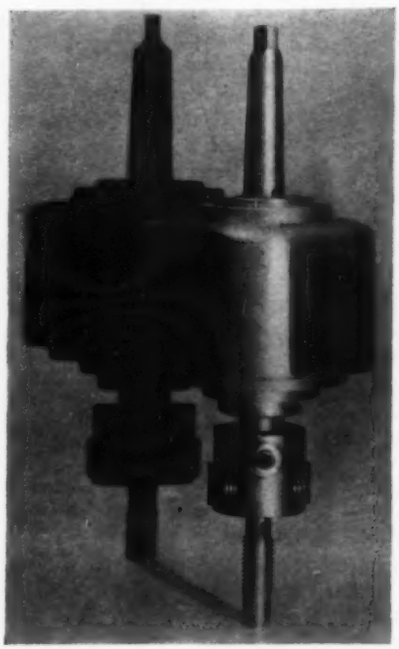
Skilsaw Electric Hand Grinder

This compact electric tool, placed on the market by Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill., is designed for use in production work, repairing and die and mold making. The motor is specially designed, with armature

statically and dynamically balanced to eliminate vibration. It operates on either a.c. or d.c., delivering 18,000 r.p.m. The body is made of molded bakelite. Cooling of the motor is taken care of by a special fan. An air filter protects the intake. The grinder weighs 2¼ lb.

Jarvis Tapping Attachment

The Charles L. Jarvis Co., Gildersleeve, Conn., has added the Biax No. 2 tapping attachment to its line of ball-bearing, high-speed tools. The attachment has a capacity from ¼ to ¾ in. and is entirely ball bearing equipped. Special aluminum alloy is used for the housing. Forward as well as reverse friction and double reverse speed are



provided. The gears are of chrome-nickel steel, and the friction material is Textolite. All gears and frictions are run in oil-absorbing grease. High speed is 3,500 r.p.m.

• TRADE • PUBLICATIONS

CEMENTED CARBIDES. The Carboloy Co., Inc., 2985 E. Jefferson Ave., Detroit, Mich., is distributing a 36-page booklet SC-35, "Complete Information on the Profitable Use of Carboloy Tools." This booklet contains in detail the following information: Detailed description of the six major benefits users can obtain from Carboloy tools; an explanation as to the size of plants which can use the material profitably; an outline of what educational work and equipment are necessary to start using such tools; description of the four ways in which Carboloy may be purchased, with information enabling the user to select the most economical method for his particular requirements; complete operation and design recommendations; explanation of the service the user can expect from company representatives; illustrations and descriptions of the materials Carboloy tools can economically machine; types of tools now being tipped with the material, and operations which are successful with this tool material; physical characteristics, applications of each grade, including a description of the uses of several new grades; a list of all tool and machine manufacturers licensed to supply their tools equipped with Carboloy.

COMPRESSED AIR ACCUMULATORS. The Seamless Steel Equipment Corp., 39 Broadway, New York, N. Y., acting as representative of the Hydraulik G. m. b. H. of Duisburg, Germany, has put out a pamphlet entitled "Hydraulik Accumulators," which describes the advantages and method of operation of these compressed-air accumulators without pistons or floats.

CORROSION OF IRON AND STEEL. The latest report of A. S. T. M. Committee A-5 on corrosion of iron and steel discusses in detail many of the exposure tests under way. Copies of this 32-page report are available at 50 cents each from the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

GRINDERS. Nine models of band grinders are shown in a catalog published by the Walls Sales Corp., 96 Warren St., New York, N. Y. All models are illustrated, and specifications are listed for each.

HEAT-TREATED FORGINGS. The Kropp Forge Co., 5301 W. Roosevelt Rd., Chicago, Ill., has issued a bulletin "Heat-Treated Forgings" in which it presents its line of specification steels.

RHEOSTATS. The Udylite Co., 1651 East Grand Blvd., Detroit, Mich., in a pamphlet "The Udylite Rheostat" presents its line of rheostats for use in electroplating processes. "Some Pointers on Rheostats" are included.

THERMOSTATIC BIMETAL. The General Plate Co., Attleboro, Mass., has published a Bulletin No. 301 describing its "Truflex" thermostatic bimetal. Contained in the bulletin are graphs and charts to be used as an aid in the design of thermostatic elements.

WELD-O-METER. The "Weld-O-Meter" is a quick reference circular disk chart that tells the correct type of equipment and the right control settings to use for spot or flesh welding any gauge metal at any required production rate. It has just been developed and issued by the Thomson-Gibb Electric Welding Co., Lynn, Mass.

THE ROUND TABLE

Who Buys the Micrometers?

"What's this, Al? Buying a lot of micrometers for the men in the shop to use? Gosh, man, we always had to buy our own. Don't you pay your men enough so they can afford to buy their own tools?"

"Yes, to both questions Ed. I know we bought our own mikes and other tools. In old days some shops even had men buy their own drills and taps on the theory that they broke less if they bought them out of their own pocket."

"Not a bad idea, but we've outgrown that, I guess. Still I can't quite see spending all that money for mikes. Are you trying to play Santa Claus or something?"

"Not so you'd notice it, Ed. It's solely and strictly business—an investment, not an expense. If the mikes don't pay for themselves in a short time, I'll miss my guess."

"Just how do you figure that out, Al? You don't think the men will work any faster because you pay for their tools, do you?"

"Not a bit, Ed. But they'll do better work."

"And how, Al? You've got me guessing."

"Well, there are mikes and mikes. Most all are good when they're new. But the screws do wear and so do the anvils. And they don't all wear alike."

"And won't yours wear too, Al? What have you got up your sleeve?"

"Well, Ed, I'll tell you. We've been having a little trouble in assembling lately. The work didn't go together just as it should. All my workmen are good and used to close fits. But still the parts didn't gee without a lot of fitting. I checked the work of each man with his own mike and it was O.K. Then I took my own mike and began to see daylight. The mikes were not all like each other or like mine."

"Why not make the men get new mikes if theirs are worn out? Why should you spend money for them?

"It will pay in the end, Ed. We lose money when they're wrong, no matter whose fault it is. Now they are our property and are checked out of the tool room. Every time they go back they are inspected before they go out again. We won't have that trouble again, Ed, and it means a lot of time and dollars saved during the year."

"Perhaps you ought to have gages instead of mikes anyhow. Al."

"Maybe, in a few places. But you wouldn't expect the men to buy gages either, would you? And they need inspection for wear as well as micrometers."

Should the shop supply micrometers and other precision tools? Or should it require periodic inspection of the men's own measuring instruments?

Discussion

Finish Cuts Only

Al is overlooking the cost of production when he plans to split up the work between two machines. Suppose he had but two or three parts to machine and that he had them first roughed out on the roughing machine and then sent them to the finishing machine. It might take an hour or more to set the roughing machine and another hour to set up the finishing machine, not to mention the time required to set each part. The cost of production might be increased 25 per cent or even more, which is not to be sneezed at.

While the work might be more accurate, it is doubtful if there would be enough difference to offset the increased cost of production. All of this additional cost could be avoided and Al could have the same degree of accuracy in his work by the simple method of machining the parts that require accuracy on the better machine in one operation and machining the less important parts in the older machine, since it is certain that the same degree of accuracy is not essential in all parts.

Al's plan might be all right on lathe work where parts come in larger lots and the time for changing is not so great, but parts to be machined on the boring mill seldom come in large lots.

—W. J. Owens

Whether Al is right in keeping one boring mill for finish cuts only depends much upon an angle that was not at all mentioned—that is the size of the plant. Much depends upon the accuracy required and the amount of boring done. For example, we have a boring mill in our plant; yet we use it but seldom. It would be ridiculous for such a plant to have a separate mill for finish boring.

In another plant that does a great deal of boring they are using Al's idea—one mill for fine boring and another for the rough work. At one time they used the single boring mill, but met several difficulties. One was the time wasted in re-setting the machine for the different bores; the other, and even more important, was the inaccuracy occasioned by the many changes.

Then, too, using two machines does

much to relieve the pressure on each. Both machines last longer because not nearly so much is required of them. There is a minimum of change; a minimum of time wasted. The cuts are more accurate. So I believe that a firm having enough boring work to do would profit by using two machines. Otherwise, the investment would not be worth it. —WILL HERMAN, *Supt., Tanenbaum & Sons Oil Co.*

Codified Skill

While the NRA codes do not attempt to codify skill, they do attempt to set a minimum rate of compensation so that the workers in the codified trades or occupations will be assured of a living wage. If the employer is willing to recognize above-the-average ability by boosting wage rates above the minimum, then both the industry and the country benefit.

However, there is a certain type of employer who in the past never missed an opportunity to capitalize on a surplus of labor by cutting wages. He is now in a miserable minority that is being slowly but surely driven from the path of the prosperity parade. To cite an instance, we need to go back only before the codes came into effect, when skilled diemakers in Mid-West automobile plants were compelled by economic circumstances to work for 40 and 50 cents an hour.

Even with the codes, as in the past, the employer has the opportunity of codifying skill by refusing to hire men who do not have sufficient ability to warrant paying them the code minimum. By this means he not only protects his own interests, but he also protects his skilled employees from the chiseler who by poor workmanship would bring disrepute to the craft.

—ROBERT S. ALEXANDER.

Trade Schools

Al takes rather an extreme view of the apprenticeship system and instances the case of a boy spending several years at odd jobs in a shop where everyone else is too busy to instruct him. However, he realizes that the trade school cannot produce mechanics. His remark that the boy from the trade school understands that a screw serves the same purpose in a milling machine or a lathe shows that he expects the school to instill first principles so that a boy can approach shop work intelligently.

The trade school is not a substitute for apprentice training of the shops, but is intended to augment such training. A boy requires the more academic training of the school which it is impossible for him to gain during working hours. Some concerns that have classes for their apprentices give them several weeks of school instruction before the boys actually enter the shop. A concern having a proper scheme of instruction in the shop can take raw lads and quickly give them sufficient training to make them as familiar with machine tools and processes as are boys leaving a trade school, providing the boys supplement this training by attending evening or other part time classes.

As regards Ed's contention that the trade-school boy may have a swelled head; he is right, but it does not matter much, for life in the shop soon knocks the nonsense out of a lad and lets him see just how clever he really is.

—ROBERT HUTCHESON, *Kenton, Middlesex, England*

The above set-up is not exactly unusual. Nevertheless the shape of the part made necessary the use of some special equipment in order to insure rapid production.

You would be surprised to know how much special and unusual grinding equipment we build. Daily we are suggesting tooling for someone's special requirements. Which brings us to the point of suggesting that that someone may as well be you.

Send us prints of parts that ordinary Plain equipment will not handle economically. Then observe how our engineer's will solve the problem for your eventual profit.

189

LANDIS TOOL CO.
WAYNESBORO, PA.

Profit Motive

Under recent government regulations the cost of manufacturing has increased, but so has the demand for manufactured products. There has been much talk about government interference, but we should remember that the business man has had his back against the wall for so long that he welcomes any agency that will keep him from getting farther into the red. The government has spent billions in trying to hasten the day of prosperity, and it would appear logical that it should have a voice in business procedure.

There is no doubt that mistakes have been made and that some of the provisions of NRA will be modified, but the major stipulations are here to stay. Government is not hindering the making of profits.

—HAROLD L. WYNN,
Executive Engineer,
Pacific Electric Manufacturing Corp.

Shop Instructions

The instruction sheet is sound in the small shop and should be as much a tangible asset as a milling machine, drill press or shaper. The instruction sheet is not an unchangeable military command, but is a record of the present best method of doing a job. If suggestions made and tried out by the workmen prove better than the instructions, then the instruction sheet should be brought up to date. Sensible management will impress on the workmen that the instruction sheet is an outline of the best way that has yet been found to do the job, but that new ideas and suggestions are welcomed and needed to improve present methods.

Ed shows his narrow mental limits and his lack of broadening experience when he says that "The average man you hire hasn't any special ideas." Properly handled, average men are bubbling over with ideas far more practical than management offers, and the fortunate part for management is that these ideas are money makers. Ideas are too valuable to be killed in borning. —E. E. GAGNON.

In the small shop the instruction sheet would be an essential adjunct. However, manufacturing data incorporated in instruction sheets should be confined to designating machine stations, routing, operation sequences, tool requirements (when tools required are of a special nature), and time standards for each operation.

Data pertaining to speeds, feeds, methods, etc., should not be incorporated in instruction sheets. Proper supervision and an adequate wage-incentive system generally takes care of these functions very nicely. Neither should manufacturing data that would be a repetition of blueprint or engineering specifications be incorporated. Engineering changes, typographical errors and illegible mimeograph work are too often the cause of costly misunderstandings and errors.

The really essential information can be put on the reverse side of a 3x6-in. work ticket, and can readily be copied from master instruction cards maintained and filed by the shop clerk to whom the responsibility of scheduling has been delegated. The master instruction-card file should have a perpetual "fine combing" by selecting a few jobs each week for discussion at the regular foremen's meetings.

—IRA S. WILLIAMS.

20 *Proved Advantages*

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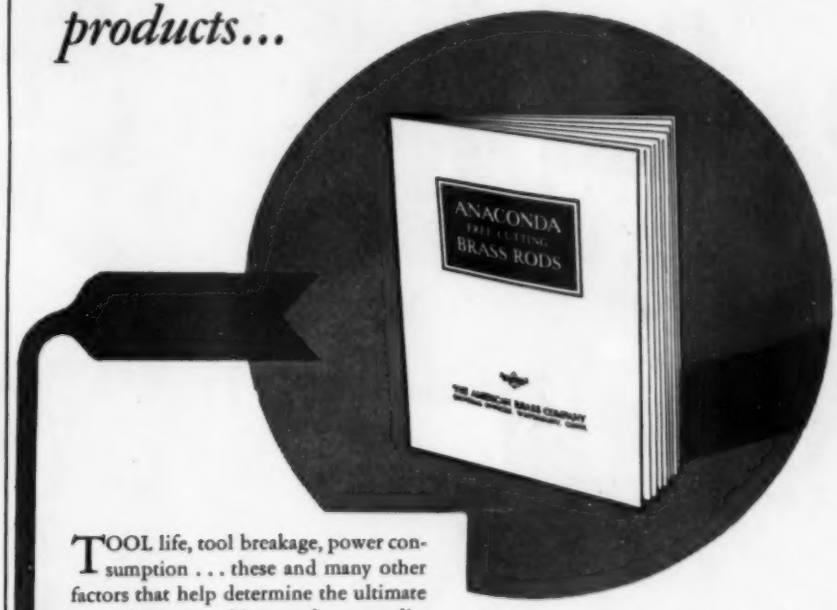

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American Machinist

FEBRUARY 27, 1935

Photo by Rittase

Fig. 1—Molten tin or lead is first cast into slabs by means of molds mounted on a circular track

Extrusion and Finishing of Collapsible Tubes

HENRY FRANK
The Sherwin-Williams Company

Air conditioning, automatic machinery and efficient handling contribute to the success of a highly specialized process for manufacturing a familiar article

LITTLE consideration is given by the average person to the details of the collapsible tube from which he squeezes his tooth paste, toilet cream or ointment. He is unfamiliar with its manufacture or with the mechanical, metallurgical and chemical problems involved in its making and finishing. Yet the fabrication of this type of container is a highly intricate operation, performed at a high rate of speed, with a marked degree of accuracy and requiring technical skill of first order.

The collapsible tube is formed from a flat disk of metal into a seamless, one-piece cylinder by means of an extruding die. In its essentials, this process consists of confining metal in a chamber with an orifice of the shape of the finished article and applying enough pressure to cause the metal to flow through the orifice. In the case of collapsible tubes, the chamber is a shallow cup die, having the exact shape of the outside of the neck and shoulder of the tube. A disk of metal is dropped into the die, and pressure is applied by a cylindrical plunger of the exact shape of the inside of the tube. As the plunger presses against the flat disk, the disk is forced into the shape of the top of the tube, and at a certain point metal is forced through the

circular orifice between the die and plunger to form the body of the tube. After removal from the plunger, the tube is trimmed, finished, decorated and lacquered by a succession of operations.

Collapsible tubes are consumed in the United States at the rate of about 600,000,000 per year, and the productive capacity of the industry is perhaps twice this amount. The resulting competitive situation puts a premium on efficiency, as is always the case under similar conditions. While by no means the largest unit in the industry, the plant of the Sun Tube Corporation, in Hillside, N. J., offers an excellent basis for the study of modern, efficient engineering as applied to the production of extruded containers.

Factory Illumination

For one thing, the building is of the modern daylight construction, with excellent diffusion and distribution of light. Paint colors of high reflective value have been selected. Bright walls and ceilings, light gray floors and green colored machines combine to give the plant an airy, clean and congenial atmosphere. Direct sunlight is regulated by the use of wood-strip blinds. And since the plant and production schedules are planned on the basis of two-shift operation, the artificial lighting system is designed to afford abundant diffuse illumination over machines and floor areas.

Not only for the comfort of the operators, but also to improve the product and to maintain the clean, dust-free atmosphere so desirable in the handling of a container for products used in or on the body, the entire factory is thoroughly air-conditioned. Dust-free air eliminates the spotting of freshly applied enamels, while even temperature and humidity permit a close control of drying. The automatically controlled baking ovens, in which tube decorations are dried, are in a separate, insulated compartment. The air forced through them is drawn from the manufacturing department. The rate of drying, gloss and flexibility of the enamels and inks depend on temperature and humidity. Exact control of these factors, in the Sun Tube plant, insures uniform and satisfactory results.

In the manufacture of collapsible tubes, the first operation involves the fabrication of the disks or "slugs" from which the tubes are formed. Tubes are made of tin and lead, the former coming from the Straits Settlements in pig form. The metals are melted in large

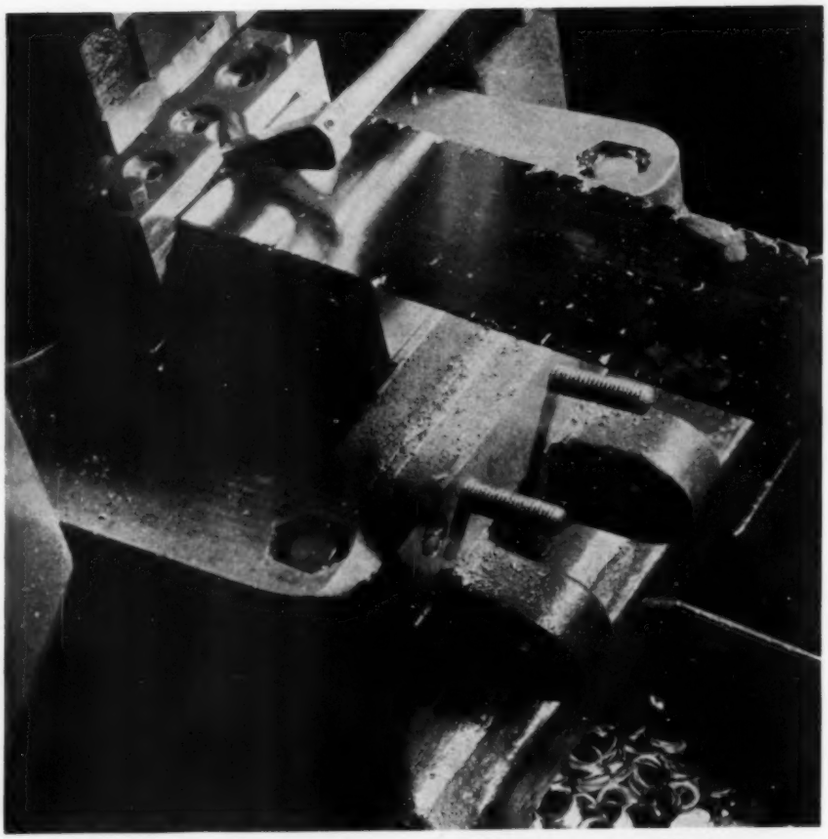
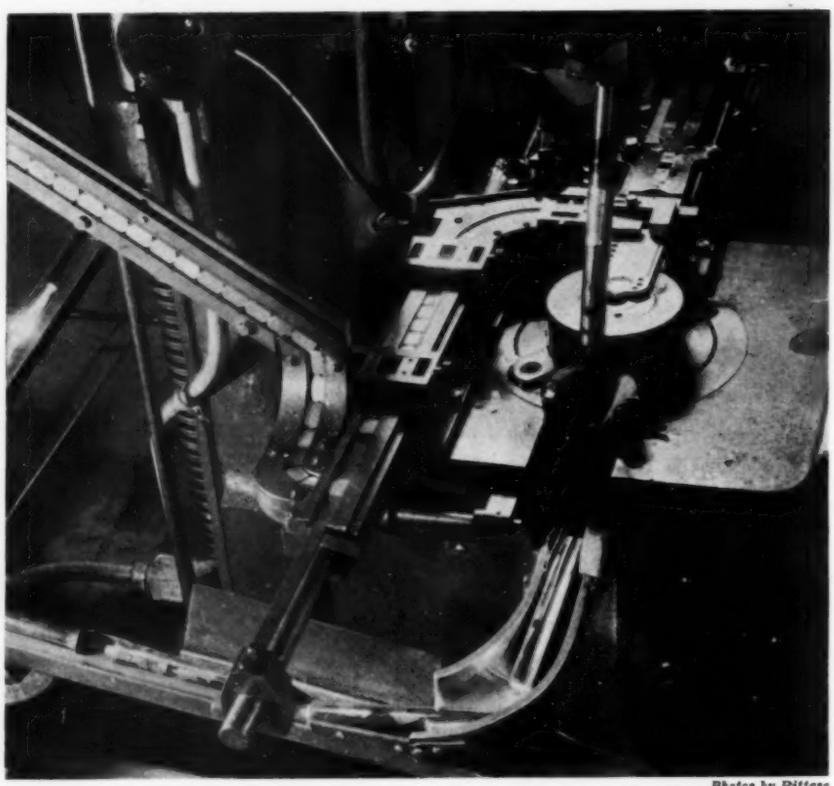


Fig. 2—From the slabs, slugs are punched in automatic blanking presses. These slabs are rolled to the proper thickness for the length of tube required. Excess material is remelted



Photos by Rittase

Fig. 3—Slugs are fed mechanically to the extruding die where the tubes are formed and then stripped by air

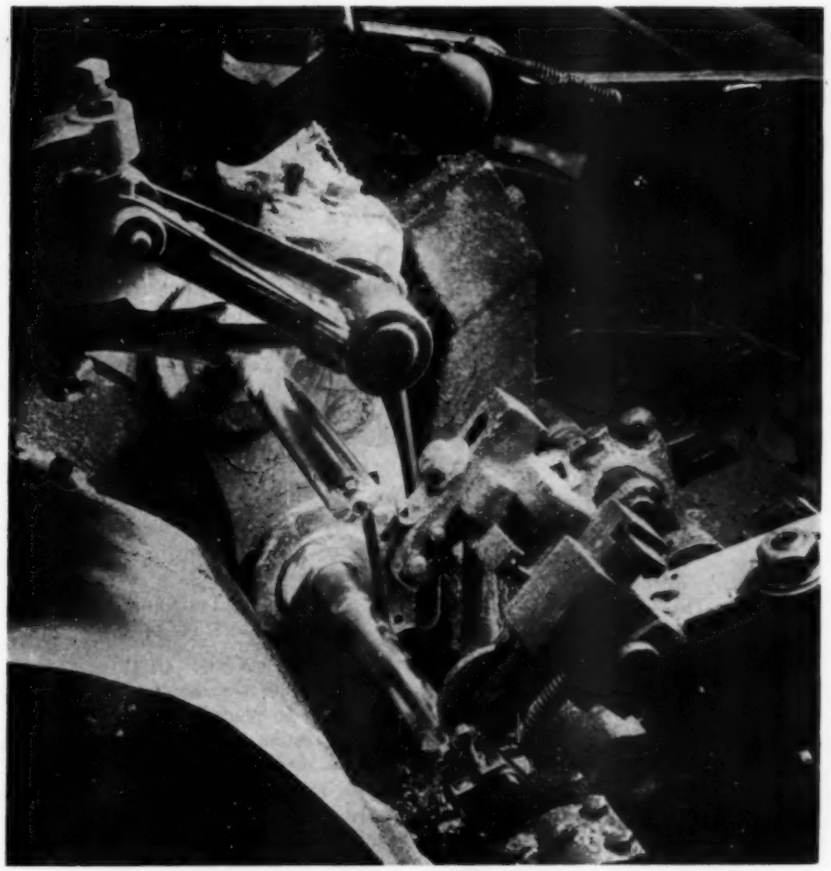
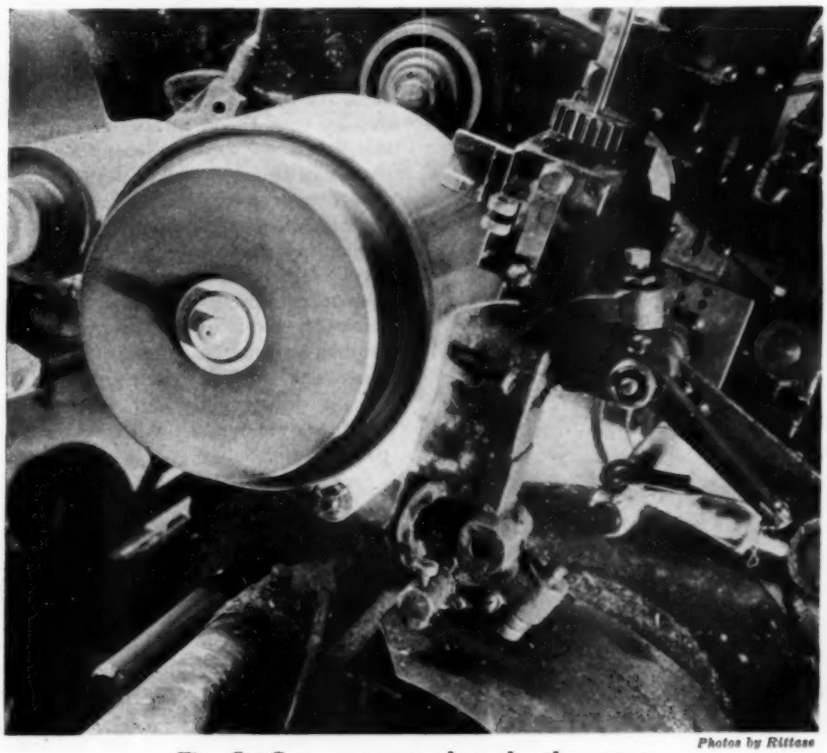


Fig. 4—Threading and trimming is performed simultaneously as shown by the tools cutting both ends of the tube



Photos by Rittase

Fig. 5—Caps are screwed on by the same machine that applies the basic coat of enamel

gas-fired furnaces, as in Fig. 1, having automatic temperature control. One interesting feature of the melting down process is the use of chemically treated wood blocks. When put into the fired kettle, a reaction sets up which serves to stir the molten metal. From the kettle the metal is run off into slab molds mounted on small cars which travel on a circular track. Each car carries fifteen molds for making 10-lb. slabs, and the average production is about 150 slabs per hour. The slabs are removed from the molds while still hot and are stacked in piles, where they remain until the entire pile has cooled to room temperature. When cooled, the slabs are rolled into strips, the thickness of which corresponds directly with the length of the tube to be made from them. It is from these strips the slugs are blanked.

The metal department evidences careful planning to eliminate handling and consequent labor costs. The placing of machines effects a continuous flow of metal from the pig to the packing of the finished tube. The blanking presses, Fig. 2, are practically automatic in operation, the return of the punched strips to the melting room being effected by continuous conveyor. The slugs are collected in wheeled bins holding up to 500 lb. of metal. These bins are readily moved from blanking press to scales and thence, by hydraulic lift, to tumbling barrels, into which the slugs are dumped for the removal of burrs and to apply lubricant required in extrusion. The tumbling barrels discharge into a bucket on a monorail system, and once the bucket is filled, the turn of a switch selects the proper station and sends it on its way. The signal control system operating between the press and the metal rooms, and the automatic dispatching system, complete a highly efficient method of handling the substantial tonnage of metal with a minimum of time and labor.

Safety Measures

Of particular significance are the efforts provided to protect the operators, mostly women, from the hazards of industrial occupation. This is especially noticeable in the design of the extruding presses. Completely automatic feeding of slugs and stripping of the extruded tubes has overcome former dangers from hand operation.

In Fig. 3, the slugs just delivered by the monorail system to the slug hopper, are shown moving by gravity to the feeding device. The mechanical feed places one slug at a time in the

die. After each stroke of the press the punch swings forward, and a jet of compressed air is released to force the tube from the punch into a chute. From here it is carried by a belt conveyor to the next machine. The press is electrically controlled by push buttons operating automatic stops, and in the event a mal-formed or wrinkled tube is produced, an automatic electric stop functions to prevent accident. While the presses are of standard design, the hoppers, feed and stripping mechanisms, and electric control were designed and built at the Sun Tube plant.

The extruding die itself, though simple in design, is the result of years of study. It requires but a small stroke of the press, and the clearance between the punch and the walls of the bottom die corresponds to the thickness desired in the collapsible tubes. In the case of Ipana tubes this clearance is 0.004 in.

Following the extrusion operation, tubes are trimmed to the proper length, the necks are threaded and faced, and the base coating of enamel is applied on a Sun designed and built machine which requires but one operator. In some cases caps are applied by the same machine. In Fig. 4, the threading tool may be seen at work while another cutter trims the tube to length.

A large proportion of collapsible tubes are made with rolled threads, which are entirely suitable for the outmoded tin caps. With the advent of the molded plastic cap, Sun perfected a method of cutting the thread which has proved to be more satisfactory than the older method.

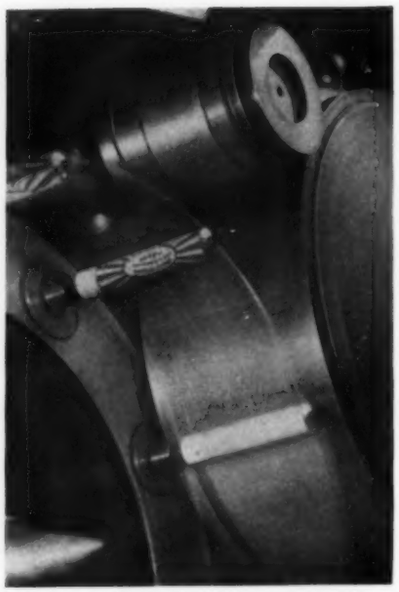


Fig. 6—The decorative design is applied in one operation, using one to four colors, by the offset process

The application of the coating enamel is illustrated in Fig. 5. After this application, the freshly enameled tube is removed by the operator and placed on a spindle of a conveyor chain, on which it travels for 30 min. through a steam-heated drying oven on the second floor. The chain, with its load of tubes, reappears from the ceiling at some distance and delivers them to the operator of the printing machine, Fig. 6, which applies the decorative design.

Again mounted on a spindle, which is borne by a revolving disk, the tube is moved into contact with a "blanket" carried by a revolving drum. The method of printing is familiarly known as the "offset" process. Each printing machine is equipped with two to four ink founts, each with its train of ink rollers. A cylinder, one to each fount, carries a curved plate representing one of the colors in the given design. As the drum bearing the blanket revolves, the small plate cylinders transfer their part of the design to the blanket, and this in turn, transfers the entire design, in from one to four colors, to the tube.

Originally, tube designs were printed directly from rubber clichés, similar to ordinary rubber stamps. Later, etched zinc plates and offset printing were adopted. Sun Tube uses engraved cylinders of steel or of centrifugally cast bronze.

After the design has been imprinted, the tube is placed on a second conveyor, similar to the first, and again travels through a drying oven. Both ovens have automatic control of temperaure and volume of air, so that a constant result is attained.

The Lacquer Coat

The final operation before packing is eliminated on some tubes, but is a practical necessity on a large proportion. This consists in the application of a strainproof and alkali-resistant coating over the decoration. Without this, soap or solvents sometimes included in tubed products would soften and remove decorating inks and enamels. Lacquer is fed from the can into a pan in which a composition roller revolves. The tube, again mounted on a spindle, is brought into contact with this roller, receiving a coating of tough, flexible, transparent lacquer which affords the desired protection. This coating dries rapidly and, when dried, the tubes are ready for inspection and packing, Fig. 7.

The protection of tube decorations presented a problem to manufacturers of both tubes and products packed in them until a special varnish was developed which gave some degree of satisfaction. The development of anti-alkali lacquers was a further step in improvement. In this case, the Sherwin-Williams finishes have proved entirely satisfactory, both in their protective qualities and in the transparency, flexibility and toughness which is so highly desirable.

Photos by Rittase

Fig. 7—A chain conveyor carries the tubes while drying and transports them to the inspection and packing department

Patents and Profits

FRED A. PARSONS
Patent Attorney and Mechanical Engineer

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IT IS the purpose of this article to discuss patents as a source of profits for the individual or for the manufacturing firm, and to explain some of the more usual reasons why it sometimes occurs that they are, instead, a source of loss or disappointment.

Many persons who consider themselves well informed lack accurate knowledge of what a patent really is, what privileges or rights it confers, what its limitations are, how to distinguish a good patent from a bad one, or how to proceed in order to get the best patent protection for a given invention or for a line of manufacture involving inventions. It may be objected that these matters belong to the patent attorney. So they do, but every person who is engaged in engineering or manufacturing activities should have knowledge of the broad principles underlying patents in order that he may be able to judge soundly the possible commercial value of patents for his particular problems. Certainly every inventor should have such knowledge in order that he can cooperate effectively with his patent attorney. The best of patent attorneys cannot be certain of producing good results unless he has such cooperation from his client, and if the client lacks knowledge of patent fundamentals, certain situations may arise which cannot be corrected by any later efforts of the attorney, or which can be corrected only by greatly added effort and expense.

Only a Certificate

A patent constitutes, in effect, a certificate that the Patent Office has examined the application in accordance with established rules, and that, so far as the Office can determine, (1) the application disclosed a patentable invention, (2) the applicant was the first inventor thereof, (3) that he has correctly followed the exact procedure established by law for an application for a patent, and (4) that for these various reasons, taken collectively, he

Protection afforded by a patent, and therefore its commercial value, cannot be greater than expressed and limited by its claims. This and other principles underlying patent protection are brought out by the author without recourse to technical legal language. Moreover, he speaks of the part played by a well-planned patent program in securing monopoly in certain markets and even in saving a business

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is presumed to be entitled to prevent any other person from making, using or selling the invention patented. None of these findings of the Patent Office are guaranteed or final. If any argument later arises, the only way in which an actual monopoly in the invention can be established by the inventor is by recourse to the proper courts, where it will probably be necessary to prove some or all of these points in order to obtain relief against an infringer. The court will give due regard to the fact that the Patent Office has issued a patent, but will form its own judgment on each of the points mentioned, as well as to whether infringement really exists in a given instance, substantially independent of the findings previously made by the Patent Office.

Patents are granted primarily for the benefit of the public, and only incidentally for the benefit of the inventor. In return for the complete disclosure of an invention to the Patent Office, where it becomes available as an addition to public knowledge, the inventor is granted a monopoly in the invention for a period of seventeen years. At first thought it may seem unfair to the inventor that, after incurring the trouble and expense of obtaining a patent, it may be necessary to prove his right to the monopoly in order to enforce the patent against an infringer, but this appears to be the only way in which the rights of the public can be preserved against invalid patents. The resources of the Patent Office are not sufficient fully to determine validity in advance of the issue of a patent. There may be many facts unknown to the Patent Office which will appear when an attempt is made by the owner of the patent to enforce the patent against an individual.

It will be noted from the above that a patent does not confer on the owner the right either to make, use, or sell his invention. Thus, if it is impossible to incorporate the patented invention in a manufactured article without infringing another patent, then no one can make, use, or sell the patented invention until the dominant patent expires, without a license granted by the owner of the dominant patent. The grant of a patent is not even colorable evidence that no such dominant patent exists, because the Patent Office makes no examination with respect to this situation. It may even occur that a dominant patent is issued several years after the patent which is dominated, whereby a legally established business in the invention of the dominated patent could be forced to cease manufacture or sale of the invention, and its purchasers forced to cease the use of articles already sold.

Dominant Patents

The existence of dominant patents already issued can be readily discovered by the patent attorney and may come to his attention in the course of the prosecution of an application, but reasonable certainty in the matter requires some expense and effort in searching out and study of previous patents, particularly if the mechanism involved is complicated.

Such work is not, ordinarily, expected to be included in the work of preparing and prosecuting a patent application, unless particularly specified by the client.

It is probably within the knowledge of almost everyone that the grant of a patent affords no basis upon which to judge the commercial value or real usefulness of the invention involved. The patent laws require that where a patent is granted the invention shall have utility, but in substance this merely means that the means disclosed by the inventor shall be operative in some fashion to effect the purpose intended. There may be a number of much better ways to effect the same purpose, each of which are well known to the Patent Office, or to practical workers in the field to which the invention relates. The Patent Office, in effect, places the responsibility for commercial value squarely upon the inventor. It assumes that the inventor knows the art in which he is working, and will not subject himself to the trouble and expense of a patent application unless his device has commercial utility. Unfortunately this often is far from the fact.

Claims Define Patent

The protection afforded by a patent, and therefore substantially all its commercial value, cannot be greater than is expressed and limited by the claims of the patent. The drawings and description must disclose and describe the invention in some workable form, for otherwise the patent if issued would be invalid, but both drawings and description are referred to merely to establish and determine what is intended to be meant by the language of the claims. The claims collectively define the exact scope of the patent which the Patent Office intended to grant, and the owner of the patent, once the patent is issued, is not entitled to enforce any larger monopoly, even if his invention was far broader than the invention claimed. Each separate claim is, in effect, a different patent grant, and the previous remarks as to patents apply to the claims individually. Thus some of the claims of a patent may be valid while others of the same patent may be invalid, yet any valid claim of such a group will still convey the right to prevent others from making, using or selling the invention defined within its own terms.

As to the individual claims of a patent, speaking generally, the larger the number of different elements which are recited in a claim, the smaller (narrower) and less valuable is the protection afforded by the claim. Thus the longer the claim, the less it protects. A claim may be valid and enforceable and still provide little or no commercial protection if it includes even one element which can be dispensed with entirely while still obtaining the desired result, or which can be replaced with other elements which do not correspond to the recited element in a patent sense and therefore do not infringe the monopoly of the claim.

How Infringed

A patent claim must invariably be considered as a combination. Thus if the claim recites five distinct elements no structure which includes four only of these elements will infringe the claim. But a structure which contains six elements may infringe the claim provided that the five which are recited in the claim are all present and performing the same combined function that they do in the patented structure, although there are certain qualifications which attach to the latter statement which are much too complicated and lengthy to be even summarized here.

It is because of the importance of the claims of a patent that, in the course of obtaining a patent, most of the argument ordinarily centers around the scope of the claims. When a patent application is filed it is assigned for examination to a division of the Patent Office which is familiar with the art to which the invention relates. In this division, or available to it, there have been accumulated copies of previously issued patents and other publications relating to the same or similar devices. The examiner searches such material to discover if the invention defined by the claims of the application, or any of them, was previously known. He then incorporates his findings in a communication to the inventor or his attorney, rejecting those claims which are found anticipated and allowing others. If any claims are rejected, these claims must then be modified, unless the examiner's views can be overcome. By the means of an exchange of views there are finally obtained claims, all of which the examiner considers allowable.

The Patent Office assumes no obligation whatever to assist an inventor to obtain the broadest or best claims which he is entitled to urge as defining his invention. On the contrary, it is usually the case that the more limited the claims, the easier it is to obtain their allowance. When the patent is issued both the Patent Office and the courts consider that the patentee has abandoned to the public any surplus of invention which is broader than the claims, and no matter how important may be the actual invention, the patent is of little or no value to the inventor unless it is properly claimed.

The proper original drafting of patent claims and subsequent modification during prosecution of the patent application under the present patent practice is highly technical, and the result can be satisfactory and certain only when the work is done by a properly qualified patent attorney. The inventor in most cases can render great assistance in the final result if he will carefully study the claims at an early stage in the proceedings and determine whether every element recited is necessary to the desired result.

This cooperation between the inventor and the attorney is assumed, in fact, to have taken place before the patent is issued. As above pointed out, the inventor is presumed, when the patent is issued, to have abandoned everything which he might have claimed but did not. Errors in claiming the invention can in some instances be remedied if undertaken within a reasonable period after the patent is issued, but at the best, this can only be done at considerable added expense, and the fact that the inventor did not realize or understand the limitations presented in the issued claims does not relieve him from a heavy burden of doubt, both in attempting to obtain a reissue, and later in attempting to enforce a reissued patent.

Graduate the Claims

It must not be understood, however, that all the claims of a patent should be the broadest claims which can be obtained from the Patent Office. It frequently occurs that facts unknown to the Office when the patent was issued narrow the claims which the inventor was really entitled to obtain. In such a case, if the patent contained only the broadest claims obtainable at the time when the real facts were not before the Patent Office, all these claims would be invalid and the patent would be worthless. In anticipation of such a possibility the claims of the issued patent should be graduated in scope, from the broadcast which the inventor can obtain at the time the patent is issued, down to the narrowest which will afford any useful pro-

tection. By this means some of the claims may be enforceable even if the broadest claims later prove to be invalid.

In this country an inventor may publish a description of his invention or use the invention publicly, and later obtain a patent if the application is filed in the Patent Office within two years of the first publication or use. In certain foreign countries the rule is different. In Great Britain, for instance, any public knowledge of the invention before the corresponding United States application is filed is sufficient to make the patent worthless. In a recent instance very valuable British patent rights were lost because the sales department of a manufacturing concern published a description of a new product in a British magazine at the same time that similar publication was made throughout the United States.

Diligence Essential

Patents are intended to be granted only to the first inventor, but the act of invention is not ordinarily complete until the invention has been reduced to practice either by the filing of an application disclosing the invention in workable form, or by building an operative device. The inventor who first becomes active in thus reducing the invention to practice is, ordinarily, in the winning position in the event of a contest between rival inventors. If the reduction to practice consists of a filed patent application, the application itself is sufficient proof that the invention was reduced to practice at the date of its filing, but if the reduction to practice is effected by constructing a device, it must be proved by acceptable witnesses or records. For this reason the keeping of inventions secret is a very dangerous practice. Moreover, the patent laws do not look with favor upon one who tries to keep his invention secret. As previously pointed out, the patent monopoly is only intended to be granted to an inventor who is willing to add his invention to public knowledge. If the inventor is convinced that his invention is valuable, he should provide his patent attorney with all the information available at as early a date as possible, preferably in a form that can be preserved as a record, and if it is desired to build a device before a patent application is filed, he should report to the attorney frequently as the work on the device progresses, advising what has been done, and the results accomplished. By proceeding in this manner the inventor will be in a position to prove the facts with respect to the date of his invention and its reduction to practice. The course here suggested involves some extra effort, but the effort is amply justified in the event of a controversy. Somewhat added security for very important inventions may be had by obtaining back from the patent attorney or some other person who can fully understand the invention copies of the drawings or reports submitted as above, preferably in photostat form. These should be signed by the other person, witnessed by a third person and dated. If such additional records are considered necesary or desirable, they should be very carefully preserved without changes.

As may perhaps be inferred from the previous paragraph, a contest of rival inventors is often decided solely by the diligence displayed in reducing an invention to practice. Thus the second person to conceive an invention may be awarded the patent if the first person has failed to proceed diligently with a reduction of the invention to practice, provided the second person has been diligent. Here, again, the importance of records such as those just mentioned is obvious. If the contest hinges on diligence, then diligence must be proved, and the inventor who has concealed his invention or concealed its reduction to practice may find it difficult or impossible to prove his diligence.

Amateur Inventors

Perhaps one of the most common errors of inventors is to invent in a field in which they have no real knowledge of what has previously been done by others. Valuable inventions sometimes appear to have originated under such conditions. As a matter of fact, they very soldom do. One of the ways of obtaining a knowledge of what has been done is to study issued patents and other publications, but if an art is rapidly advancing in a commercial way any information available in published form may be several years behind the filed but unissued patent applications of other workers. This is particularly true with respect to those industries in which large organizations have established research or development departments. Such departments invariably work closely with competent patent attorneys. However, in spite of the trend of modern industry to employ inventors for the particular purpose of patentable development, many valuable inventions are contributed by those who may be classed as amateurs.

The tendency of modern large business concerns to produce patents wholesale is, of course, mainly limited to these industries where the sales product is of a technical nature and subject to constant improvement, but the practice has resulted in what may be termed a new sort of patent, or at least in emphasizing a type of patent which in the past was only an incidental and more or less unintentional by-product. Such patents are those whose chief value lies in preventing a possible avoidance of some other patent, or whose intended purpose is to provide one of a group of patents which, taken together, accomplish a monopoly which would be impossible, for one reason or another, by any single patent. There are many industries such, for instance, as the machine tool industry, where the present opportunities for basic or broad patents are very few, yet substantially the same effect may be produced by a group of patents each directed to different methods of accomplishing some relatively minor improvement, and together establishing a monopoly of the improvement. One or more such groups of improvement patents can establish a monopoly of the product in its modern form, and, in effect, a monopoly on the sales of the product.

Somewhat the same result as is obtained by group patents may be accomplished by competitive firms in the fixing of minimum prices at which goods may be sold. Under ordinary conditions it has been, for many years, illegal for competitors to establish a monopoly or fix prices by mutual agreement, but both monopoly and minimum prices can be legally accomplished by the use of patents. Several large industries, each comprising a number of concerns who are active competitors, have saved themselves from the losses occasioned by price competition through price fixing arrangements established and enforced in this manner. The penalty for failure to maintain prices is, usually, a loss of patent rights.

New-Type Attorney

These tendencies and necessities of modern industry have also resulted in a new type of patent attorney. There is no name to describe his work as yet, but it can be indicated by calling him a technician-inventor-attorney. He knows by experience or study all of the practical details of the art in which he specializes and the trend of its future development, and he can forestall such trend by inventing and de-

signing commercially acceptable machines or product which will be required a few years hence. He also knows sufficient of patent law and practice either to do or to direct the patent work which will provide adequate future patent protection for these developments. As an illustration of this sort of work, a firm which a few years ago was in imminent danger of eclipse or collapse by reason of the patents owned by its competitors has now completely reversed the situation. When the situation was first realized, this firm found itself under immediate necessity of doing the best it could to improve its sales product in spite of its competitors' patents. The engineer-inventor-attorney, working with their regular engineering department, was able to provide adequate non-infringing designs for the intermediate period, usable until such time as the trade began to demand the new and patented product.

Patent work of the sort just described is not necessarily out of reach of even the smaller manufacturing concerns who find it desirable. If properly undertaken and carried out, it puts the smaller concern on a patent basis which is comparable with, if not superior to, that of his larger competitor. The larger firm may group together its experts, its inventors and its patent attorneys, and thereby establish, in effect, a separate department for the manufacture of patents, but such a department, at best, suffers under the usual handicaps attendant upon any collection of separate individuals trying to accomplish a highly complex simultaneous result. In some instances these new type patent attorneys serve a group of different concerns whose patent interests do not conflict, thereby still further reducing the expense for the individual firms.

Adequate Protection

In conclusion let it be emphasized that profits from patents are not solely a matter of inventing something valuable. Profits can only be had if the thing invented is adequately protected. For the individual or amateur inventor good protection may ordinarily be accomplished by employing a competent patent attorney and then cooperating with him intelligently and with some understanding of the difficulties which he will face. For the business concern there are other factors to be considered, particularly where the sales product is subject to changes or improvements in type or features of design. Developments made in response to trade demands of the moment are not sufficient insurance against the future, because such developments are almost always paralleled by the developments of competitors who are engaged in solving the same sales problems and therefore may patent the development for themselves. To obtain best results from patents a manufacturer should employ such a combination of engineering and legal ability as will be able to determine with reasonable certainty what his sales needs will be at a time at least four or five years in the future, and able to file applications fully protecting such sales product before his competitors recognize the necessity for such efforts. If a manufacturer will consistently follow this course he will obtain valuable patent protection which, if it does not establish a complete monopoly, will at the very least afford a basis for patent exchanges enabling him to continue to manufacture a salable product.

Ford Decimal System

It is doubtful if any system of measurement will eliminate the mental subdivision of dimensions by halves and quarters, even though we know that common fractions have many disadvantages. In spite of this natural tendency, however, nearly all toolmakers have worked with decimals of an inch for many years, even though designers have continued to use, or at least to think in fractions. And the conversion of these fractions into decimals in the shop has caused both headaches and errors.

This practice has been eliminated in the Ford plant by the use of what is known as the Ford Decimal System. This is a careful and consistent method of eliminating fractional complications and has many advantages. Scales are graduated in 50ths of an inch for convenience, but are read to hundredths. The number of decimal places depends on the accuracy required. Where a tenth of an inch is sufficient, but one digit is used, as 0.7 or 0.9. For greater accuracy, the second figure is used, but always in "two" or multiples of two, such as 0.56 or 0.62, so as to be divided evenly each side of a center line.

Easy conversion of common fractions to decimals is not the reason for the new system but rather the avoidance of the necessity for such translation. It may be likened to a system of preferred numbers, for the guidance of designers, rather than permitting them to choose any dimension, regardless of difficulty of expressing it on the drawing. And in this way, translations in the shop are avoided.

Some Hints From An Old Timer

CHARLES WESLOW

In the year 1900, I was employed in the Western Electric Company on screw machine tools. I had a job making a hat full of screw machine spring collets. When finished, I was required to harden them, and it was specified that the chuck end was to be a good hardness, with the other end a spring temper. The chuck end opened out, unlike the spring collets used for engine lathe or bench lathe use.

One of the straw bosses saw readily that I was too young to know how to harden them, and he came along and gave me a "lift." I haven't forgotten him or his name. A regular guy, I thought to myself.

Said he, "Heat the back end first (in the blow torch) and open the chuck by shoving down into it a taper rod, holding the chuck with tongs grasping the back end in a vertical position, resting it onto a metal plate nearby." I made the taper pin as he directed and made it so that it would enter the red hot chuck to a certain point.

Following his instructions, I then heated the whole chuck, but got the back of the chuck hotter than the front end, using very light tongs on the back end. I had powdered cyanide ready nearby in which I thrust the front end of the hot chuck just a second before quenching that end in water about 90 deg. temperature. That end hardened in a jiffy, and there was enough heat left in the other end to switch it quickly into the oil tank and then "burn off the oil" for the proper temper.

I have used cyanide on carbon steel many times since. A few years later, I was employed in Lovells, Arlington, N. J., where at one time I had a blanking die in the hardening furnace, while I was busily engaged on a machine. A German employed there hollered to me, "Sharlie, come quick, your die iss too hot already," and he politely informed me that it would be full of blisters, unless I treated it to a dose of cyanide, before quenching in water. Did it work? And how.

A Modern Molding Shop

HERBERT CHASE
Consulting Engineer

MANY ECONOMIES can be realized in a molding plant by the proper selection, layout and installation of equipment. This was made evident when the present plant of the Tech-Art Plastics Company was installed in Long Island City, its molding facilities having been moved from an older plant in Boonton, N. J., where the present management had gained more than twenty years of experience in molding of phenolic and other modern plastics as well as older forms of rubber.

Present facilities are all located on a single floor in a large loft building and comprise, besides the molding presses themselves, such necessary accessories as a steam boiler, hydraulic compressors and accumulator, air compressors, tabletting machines and a well equipped machine shop for making molds. As the company is organized to handle almost any molding job from a small single-cavity hand mold up to a multiple-cavity automatic mold for large production, its equipment must be flexible; especially as nearly all modern molding materials are used at one time or another.

All of the 21 presses employed are arranged in two rows, one comprising five large presses with rams 16 and 18 in. in diameter, and the other 16 presses of varying dimensions, but all having 8-in. rams. The smaller presses are used a great deal for hand molds and in making complex electrical and machine parts, but when required are equipped with semi-automatic molds. Paralleling this row is a bench, on which the hand molds are filled, and several hand arbor presses to facilitate opening the molds and ejecting the moldings. This arrangement makes for rapid and convenient handling and often enables one operator to handle two presses. Between some of the steam-heated hydraulic presses are

Steam for all twenty presses is supplied by this 9½-hp. automatic boiler with a motor driven feed pump

screw-type hand presses in which molds can be placed for slow cooling when required.

An important feature in convenience and economy of operation is the arrangement of the piping and connections thereto for each press. All piping mains run in back of the presses and parallel to the row, against columns on the inside row and against the wall on the outside row. There are eight parallel rows of piping for each row of presses, comprising, from top to bottom city-main water, reduced pressure steam, high pressure steam, low pressure water (500 lb. per sq.in.), high pressure water (3,200 lb. per sq.in.), high pressure and low pressure hydraulic return lines and a steam return line.

Thanks to a good job of piping, in which all high pressure lines have welded outlets instead of T's with screwed fittings, leaks are avoided and the floor kept dry. Each press has its own set of outlets and return connections and each outlet is controlled by a valve next to the main so that any press can be shut down, disconnected and moved, if required, without interrupting work on other presses. The branch pipes to each press are kept close together, and there is plenty of room left behind each press so that the molder can get behind it readily if occasion requires. Each press has a full set of connections so that molds are not only heated readily, but can be cooled with city water in case cellulose acetate of some other thermo-plastic material is used. Each press has its own hydraulic pressure gage, steam trap and, of course, its own control valves; many of the latter are of the automatic type operated with a single lever.

Water at 500 lb. pressure for closing the presses is furnished by an Elms horizontal triplex pump. When the press is closed, the high pressure line is opened and the full 3,200-lb. line pressure is applied. This arrangement, of course, economizes in the use of high pressure water. The latter is supplied by a vertical triplex Dean pump with which an accumulator is connected. The accumulator, which maintains uniform pressure and makes it possible to use a smaller pump, is balanced against an air cylinder and air receiver which are pumped up about once a week to 250 lb. per sq.in. pressure. This arangement keeps the accumulator remarkably steady, avoiding the constant and rapid motion so often found with an ordinary accumulator arrangement. Another small air compressor furnishes air at 50-lb. pressure for blowing out molds and like applications.

A noteworthy saving results from the arrangement for furnishing steam at the required 125 lb. per sq.in. pressure. As city regulations require the attendance of a fireman if a boiler of 10 hp. or more is used, and it was desired to avoid this expense if possible, especially as the shop operates most of the time on three shifts, it was decided to try using a single boiler of 9½ hp. placed quite close to the presses so that line losses would be minimized. As much larger boilers are commonly used in shops having this number of presses, there was some doubt of the success of this arrangement, but it has proved eminently satisfactory. The boiler selected is a Keen vertical type, about the size of an ordinary house-heating furnace, and it occupies only a few square feet of floor space together with an automatic boiler feed having a small motor-driven pump. City gas is used to fire the boiler, and the entire steam installation works automatically and requires practically no attention, the steam pressure being held constant.

One hand pump and one electrically-heated press for use primarily with experimental molds are provided and used occasionally on Saturdays or at other times when the shop is normally closed down.

Weighing and Timing

Other equipment and arrangements are much the same as are found in other molding shops. They include a J. F. Stokes tabletting machine for making preforms for production runs without the need for weighing each charge. There is also a separate room in which the weighing of compounds is done; these often being placed in paper cups and delivered in trays to the molding benches, so that molders do not have to weigh charges themselves or use volume measurements. Several preheating ovens are provided for preheating charges when this practice is desired to shorten the molding cycle. Timing is done to some extent with suitable hour glasses or by the use of special clocks designed for the purpose.

Occasionally, when a special compound for a particular service is required, it is mixed in the weighing room to a formula carefully worked out to meet the special condition. Some compounds, containing a small proportion of rubber, as well as phenolic resins, are occasionally used to give high moisture resistance and special dielectric properties. In general, however, standard ready-mixed compounds are employed. Some of the presses

are connected to steam lines in which the 125-lb. normal line pressure is lowered, through a reducing valve, to give the lower temperature sometimes recommended for certain of the urea compounds.

Cleaning of fins is done mostly by hand, but some small parts are tumbled and some circular parts are put into light lathes with friction chucks to finish edges where fins occur, and some cleaning wheels are used. Drill presses are occasionally used for drilling or polishing operations. Punch presses are available for making small inserts and supplementary assembly parts and riveters for assembling when this is required.

Toolroom equipment includes several lathes, milling machines, drill presses, a shaper and some other tools sufficient for making all the molds required. This department is also charged with making a new form of experimental mold from a special cast alloy which is easily and quickly machined, especially as the cavity in this case is cast close to actual size. Such molds are employed only for making sample moldings for which they are designed, but can be produced for such items as packages (boxes, jars and the like) at a remarkably low cost. In fact, the company will undertake to make a half dozen molded samples of almost any part of this nature that does not measure more than 4 in. deep and about 5 in. in its largest dimension for about $25. This is important in producing decorative items, as customers are often reluctant to invest several hundred dollars in a production mold until they have in hand actual molded samples from which to judge exactly how the finished product will look.

Molds made for this purpose, however, are not good for production runs and are remelted as soon as a few samples are turned out. Work of this kind is done for other molders as well as for those customers interested in having Tech-Art do production molding for them. Experimental molds of this kind can usually be completed in about two days and, because of their low cost, involve little loss whether the sample is put into production later or not.

In the right foreground is a mold for forming a Thermos bottle case; molding is done in the press at the left

A 20-Cent Camera

An illustration of the remarkable economy possible in the quantity production of certain types of items made is the complete camera developed for the Woolworth chain of five- and ten-cent stores. This camera takes pictures on motion picture film and is produced complete to retail at 20 cents. It involves two main molded parts, forming the front and back of the camera body and three smaller moldings, namely a shutter cover, a winding knob and a film spool. These are produced at less than six cents per set.

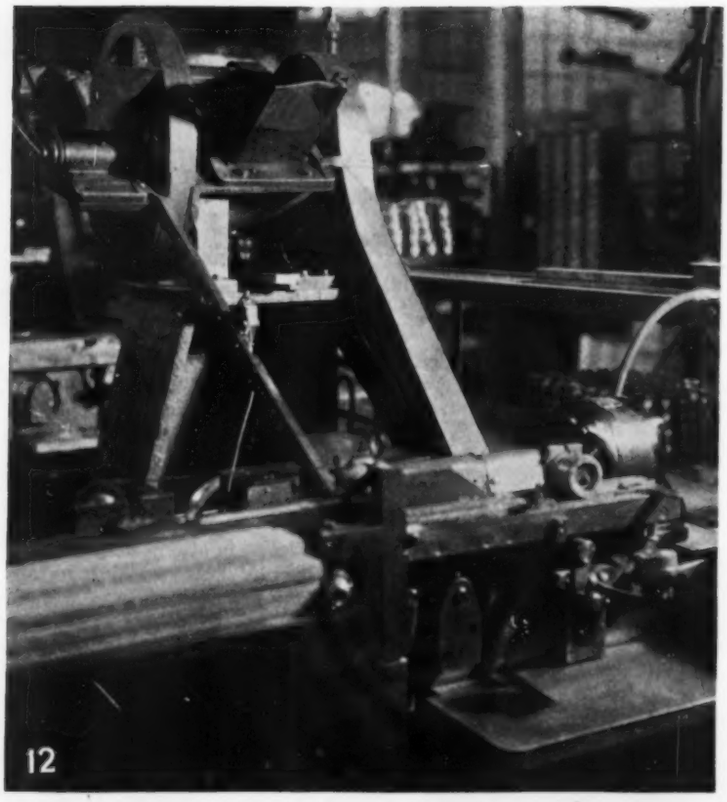
All holes except one, which is drilled in one molded part, are cored. Assembly, which includes the heading of four small rivets, costs less than one cent per camera. The two largest moldings are produced at a rate exceeding 100 per hour from six-cavity molds. They are made from a phenolic compound which originally was black but which is now brown with colored mottles, intended to increase sales appeal.

As cost considerations make it impossible to use a ground lens, it was found that one produced in a highly-polished mold would give a ground and polished appearance and serve its purpose satisfactorily. Molds for this lens were made by Tech-Art, but the lenses were produced by a specialist in the molding of glass. When finished the lens is merely dropped into the molded recess provided for it and is covered by a paper washer having a hole of the required size to admit the necessary amount of light. This is covered in turn by the shutter assembly plate, containing two holes which register with projecting nibs in the front half molding, after which the shutter cover is pressed into place and holds the parts under it in position.

When it is realized that cameras of this type must wholesale at about fifteen cents each, it must be apparent that it is possible to produce certain classes of articles by molding at extraordinarily low figures. In this instance, over 250,000 cameras were delivered, a production which warranted a considerable investment in molds, but there are many other instances in which molded parts are used to great advantage when much smaller production is involved.

STARTERS AND GENERATORS IN PROCESS

II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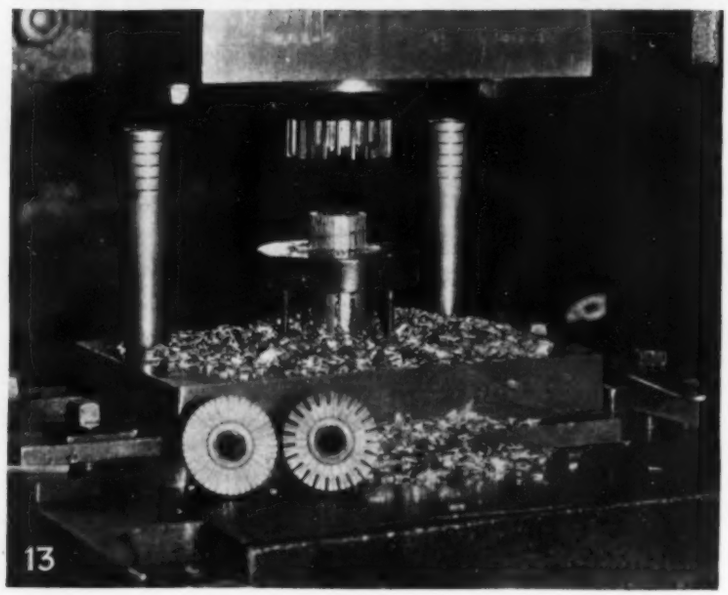
WHEN the first part of the article was published (*AM*—Vol. 78, page, 845), there were discussed the operations on the frame of the Auto-Lite starter, the pole pieces, the armature shaft, and the armature disks.

● How the commutators are assembled on a pressed steel case is a story in itself. Some are assembled by hand, with mica between each bar, by girls who are highly skilled in this work. There are also assembling machines, as in Fig. 12, where the bars are dumped into a magazine hopper, sorted for position by a special agitator, and fed down the chute to the assembling slide. After each bar feeds into the line a piece of mica insulation follows it, so that the bars are properly separated as they pass to the assembly fixture itself. When this is filled the operator rolls the bars and their insulation into a ring that goes by conveyor to the operator who fastens them in position.

● Before being pressed on the armature shaft, the projecting ends of the bars are slotted, rapidly and accurately, in a punch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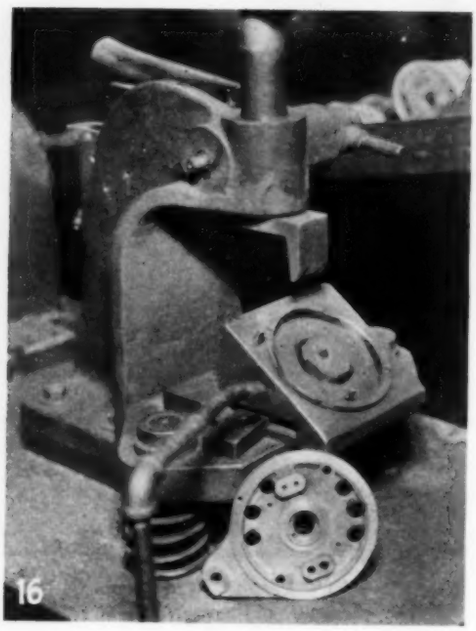
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press, as in Fig. 13. The commutator is placed in the supporting fixture on the bed of the press, when a single stroke of the press forces a punch through each bar, leaving a clean-cut hole for connecting the ends of the armature winding.

● After being pressed on the shaft the commutators are carefully turned and ground, the insulation undercut with small burs that are almost of the dental order, and the armature is ready for the assembly line.

● The armature is supported by end pieces which carry the bearings. In the older designs these were of cast iron but pressed steel is replacing the castings on some later models. These end pieces are a nice job of punch press work, both as to the dies used and the work itself, but also in the way in which the pieces are handled from one press to the next. There are five operations, the back of the press line-up being shown in Fig. 14, to show how the work is handled after leaving the press while Fig. 15 shows how they are automatically delivered to the next press.

● Blanks come to the first press and are delivered in front at the operator's left hand. As they leave the first press they drop to the chute behind the press and are picked up by the short belt conveyor between the presses. This carries them up and dumps them in a bin at the second operator's left hand, and so on down the line.

● Two very interesting operations are done on the cast iron end plate on simple devices designed and built in the plant. One of these is the drilling of the drain hole, which is a bit awkward to handle in a machine of the usual type. The little machine in Fig. 16 however, has an inverted spindle. This makes it easy to locate a piece in position on the angular plate, which is mounted on springs, and an arbor press forces the piece down on the drill. Chips fall clear of the drill, and an air jet helps to keep the fixture clean.

● Another operation is the making of a short curved recess as in Fig. 17, which also shows the special milling fixture on which it is done. After clamping the piece, the end mill is fed down and spot faces, or recesses, a hole at one end of the slot. The mill is raised, the work indexed and a hole spotted at the other end of the slot. Then, with the mill still at the depth of the hole, the work is rotated on its center until the milling cutter completes the slot into the other hole.

● The third, and last, part of the article will be published soon.

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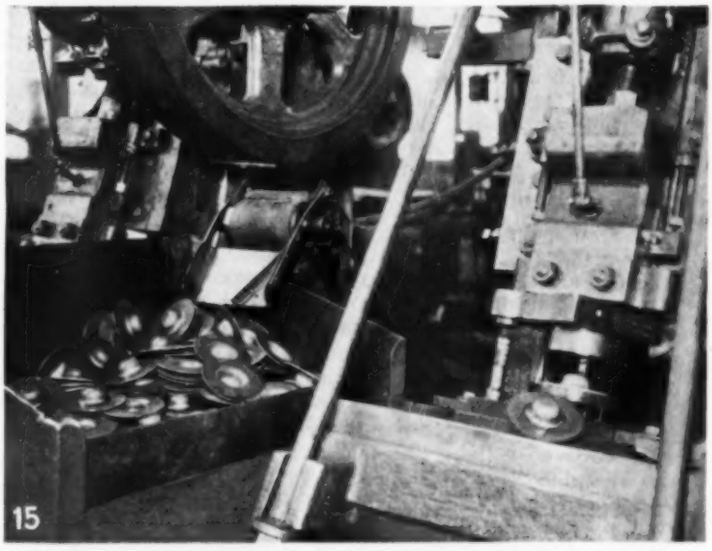
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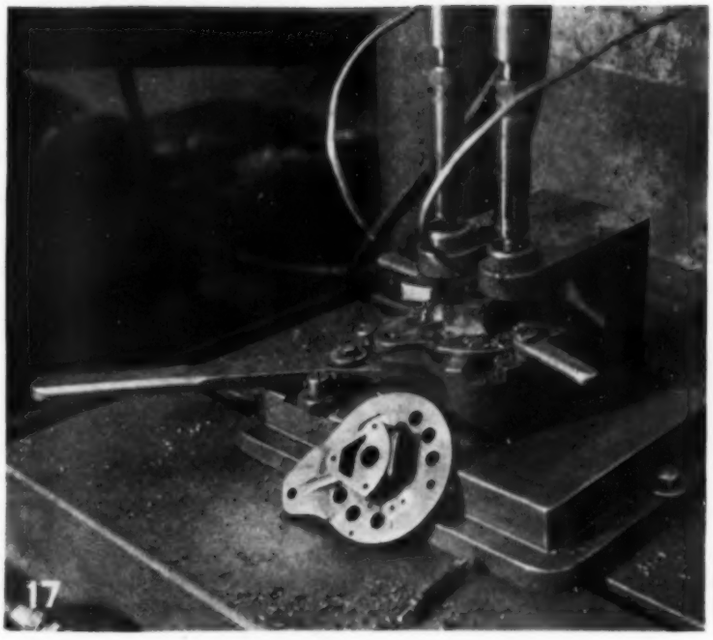
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Why Spring Stiffness Varies

R. W. CARSON
Assistant Editor, Product Engineering

Changes in temperature, variations in working stress, and the relief of internal stresses, or combinations of the three, introduce variations in stiffness of springs and other machine parts

THERMAL expansion and loss of strength at high temperatures are well known properties of common metals, but temperature changes also alter the stiffness or the elastic modulus (ratio of load to deflection) causing changes that under some conditions are of even greater importance than thermal expansion or loss of strength. The stiffness is also affected by two other factors: intensity of stress and aging. All three of these factors cause stiffness changes that often are of sufficient amount to have considerable influence upon the operation of machinery. It is essential, therefore, to know the extent of the stiffness variations, what difficulties arise from these variations, and how to control them.

Three Sources of Variation

In any metal, a non-uniform ratio of load to deflection, apparent as a variation in the stiffness of the metal, is a possible source of difficulty under three conditions: (1) in calibrated springs, (2) in machine parts subjected to steady loads, and (3) in springs or other elastic elements under a constant deflection. Under the first condition, a change in stiffness causes a change in calibration. In a scale spring, for example, a change in modulus introduces an error in the scale indication. Not only in springs, but in any type of spring member where deflection or loads are measured in terms of each other, a variable elastic modulus presents an undesirable condition.

For the second condition—machine parts subjected to a constant load—changes in elastic modulus result in changes in load deflection. Such changes in stiffness, like thermal expansion, may set up undesirable stresses in machine frames or mechanisms because of unequal rates of change in different metals used. The third case is similar except that loads will alter with a change in stiffness when the deflection is constant. For example, the pressure exerted by a compression spring held to a constant length, will vary directly with changes in the elastic modulus. In any mechanism or construction involving any of these three types of elastic members, modulus changes are possible sources of difficulty.

Ordinary metals lose stiffness as the temperature increases, the same load causing a greater deflection, or the same deflection resulting in a smaller force. This is a reversible effect like thermal expansion; that is, the ratio of load to deflection returns to its initial value when the temperature is again brought back to normal.

Effect of Temperature

The effect of temperature in causing changes in the ratio of load to deflection may cause trouble in machines in which parts may be heated, although the actual temperature increase may not be very great. A valve spring in an automobile, for example, if made of steel will lose 1 per cent of its stiffness with a temperature increase of only 70 deg. F. If the spring is made of phosphor bronze, its stiffness will decrease nearly 2 per cent. A similar loss of stiffness with increase in temperature will occur for other metals, as shown in the accompanying chart, Fig. 1, which gives the loss in stiffness for a temperature increase of 100 deg.

This change in stiffness varies directly with the temperature up to 200 deg. F. or higher. The change in stiffness M in per cent for a corresponding change in temperature T in deg. F. can be obtained from the following relation in which e is a constant for a given material.

$$M = eT$$

Values of e for a number of materals in both hardened and annealed conditions are given in Table I. For any of these materials the per cent change in stiffness for a given increase in temperature can be obtained by multiplying the temperature change in deg. F. by the constant e. The values of e are from data published by the National Bureau of Standards in Journal of Research Paper R.P. No. 531, "Temperature Coefficient of the Moduli of Metals and Alloys Used in Elastic Elements," by G. H. Keuligan and M. R. Houseman.

In long tie bolts, in furnace parts subjected to relatively high loads, stressed parts in die casting machines and in die casting dies or molding dies for plastics, change of elastic modulus with temperature may alter bolting pressures, fits and clearances unless this factor is considered.

Heat-Treatment Has No Effect

Heat-treatment, cold working or fabrication has little effect on the change of elastic modulus with temperature. With the exception of some of the high-chromium stainless steels the changes are characteristic of the metal. The alloy steels all show approximately the same loss of stiffness with increase in temperature,* while copper-base alloys such as brass, bronze

Table I—Per Cent Change in Stiffness for 1 Deg. F. Change in Temperature

Material	Hardened or cold drawn	Annealed
High carbon steel	0.014	0.011
Piano wire	0.015	0.012
5% Nickel steel	0.016	0.014
Chrome-vanadium steel	0.015	0.014
18-8 stainless steel 0.15 carbon	0.024	0.022
Monel metal	0.016	0.016
Nickel silver	0.019	0.018
Beryllium copper	0.019	.....
Phosphor bronze	0.021	.....
Brass	0.022	.....
Elinvar	0.004	.....

Table II—Values of *k*, Stiffness Variation Factor, for Spring Materials in Tension

3½ per cent nickel steel	4.3
Music wire	4.8
1 per cent carbon steel, hardened	5.0
Hard-drawn steel spring wire	6.8
Phosphor bronze wire	5.4
Spring temper brass wire	4.6
Duralumin	10.9

and nickel silver each have about the same amount of temperature effect, somewhat greater than the change in steel.

For high carbon steel annealing does reduce the amount of change, but ordinarily this material is used in the hardened condition in which the change is comparable to that of other steel alloys. Some of the stainless steels, however, exhibit modulus changes much higher than the ordinary steels, the 18-8 type having a greater temperature change than brass or phosphor bronze.

Other nickel steel alloys have been developed in which the temperature change is small or in the opposite direction to the usual change. One of these materials known as elinvar, an alloy of chromium, tungsten, nickel and about 50 per cent iron, has little or no change with temperature over a rather limited temperature range. Another nickel alloy with about 65 per cent iron becomes stronger with an increase in temperature. In a recent metallurgical development the first alloy has been modified by the addition of small amounts of several other elements with the result that, after extreme cold working and heat treatment, this alloy becomes stable and strong enough to withstand working stresses of 60,000 lb. per sq.in. By minor variations in the composition, the temperature range over which the elastic modulus remains constant can be shifted as required. Because of this combination of good physical properties with a constant load-deflection rate, this material is finding applications in weighing devices, testing machines and steam gages. In any other applications where a constant elastic modulus is desirable, this material is one possible solution to the problem.

Control over the effect of temperature on the elastic modulus is essentially a metallurgical problem; conditions controlled by shop processes can influence the effect little or none at all. In general, the same conditions also apply to the second type of modulus change — the variation caused by changes in the load.

Available data on the change in elastic modulus with load are not very complete, but the tests already reported show in general the magnitude and characteristics of this effect. Under tension loads the deflection rate increases with the stress. With higher stresses the elastic modulus thus becomes smaller, and the stress strain curve in tension is a curve in fact.

An investigation of this effect has been reported by M. F. Sayre in a paper, "Elastic and Inelastic Behavior in Spring Materials" published in the A.S.M.E. Transactions, Vol. 53, 1931, Applied Mechanics Division, pages 99-105. As shown by Mr. Sayre's experiments, the stiffness varies with the stress even at low stresses. This effect can be interpreted more clearly by assuming, for example, that at half load a tension specimen extends 1.000 in. When the remaining half of the load is applied, the increase in extension will be greater than 1.000 in.; for phosphor bronze the second half of the load would cause an extension of 1.006 in.

Equation for Stress Effect

For loads applied in tension the amount of change in the ratio of load to deflection varies somewhat with different materials but for a given material the changes are so consistent that they can be represented by a mathematical relation. For loads applied in tension, M, the decrease in stiffness in per cent, in terms of the stress S and the elastic modulus E is given by the relation.

$$M = kS/E$$

In this equation k is a constant for a given material. For music wire the value of k is 4.8 so that the per cent decrease in stiffness for a stress of 100,000 lb. per sq.in. is,

$$\frac{4.8 \times 100{,}000}{30{,}000{,}000} = 1.6 \text{ per cent}$$

Per cent decrease in stiffness for other spring materials can be obtained in a similar manner using values of k listed in Table II.

For compression loads no data are

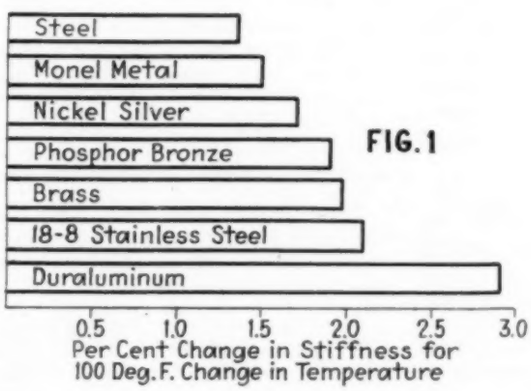

FIG. 1

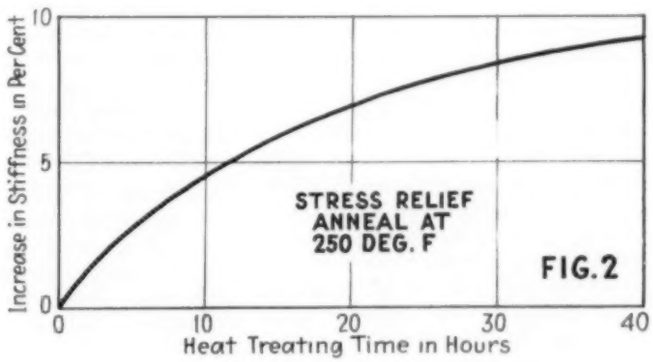

FIG. 2

Fig. 1—All of the common spring materials lose stiffness with an increase in temperature. Fig. 2—Stiffness increases with the relief of internal stresses in cold-worked spring materials subjected to low-temperature heat-treatment

available showing the change in modulus with increase in load, but it is reported that the changes are of about the same magnitude although opposite in direction to the changes found in tension. Torsion and bending loads involve both tension and compression stresses, so that the changes in ratio tend to equalize each other. However, this effect does shift the neutral axis in bending toward the compression side, slightly increasing the compression stresses.

Aging Causes Changes

In the effect of stress on the elastic modulus, as in the effect of temperature, the variations appear to arise from a molecular condition inherent in metals, the amount being characteristic of the material. Shop processes alone have little or no influence on the amount of variation found. Certain conditions dependent upon the presence of internal stresses set up by quenching or cold work affect the amount of the change, but these effects are more closely connected with aging or the effect of time—the third cause of stiffness.

The most important of the three types of stiffness variations is aging, or the change that occurs with merely the passage of time. The effect of aging on other physical properties such as strength, ductility and hardness is well known, but similar changes also occur in the load-deflection rate, that is, the elastic modulus gradually changes in value and in characteristic. Aging may introduce stiffness changes only at certain stresses, or the changes may be effective at all stresses either increasing or decreasing the elastic modulus. The amount of change may become as much as 5 per cent, usually causing an increase in stiffness, and therefore a decrease in steady load deflections.

In contrast with the two other types of modulus changes, aging effects have not yet been reduced to an equation, nor is there any immediate prospect of applying mathematical analysis. In contrast also is the fact that aging characteristics are independent of the material, being controlled for the most part by internal stresses in the material. These internal stresses may be set up by cold work or by quenching, while annealing or moderate heat treatment followed by slow cooling ordinarily will relieve or dissipate most of the internal stresses.

Cold work or plastic deformation of any nature hardens and strengthens ductile materials such as brass, bronze and low-carbon steel, at the same time introducing high internal stresses. Another common source of aging changes, particularly in helical compression springs, is the operation known as "surging" or "setting" in which the spring is loaded beyond the elastic limit of the material. This operation is often used to increase the safe working load, but the deformation introduces internal stresses that cause slow changes in the stiffness.

High-carbon steels and other precipitation hardening alloys such as duralumin and beryllium copper depend on quenching or the fixation of an unstable chemical composition to obtain desirable physical properties. Either cold work or quenching—sometimes both—are the common means used to increase the physical properties of metals and alloys, and it is only through cold work and quenching that they attain the properties desired for highly stressed parts. But both quenching and cold work also introduce internal stresses, the cause of aging changes. Aging, therefore, is the most common elastic modulus variation, and because these changes often proceed very slowly, they are usually the most troublesome.

Table III

Spring material	Heat-treatment
Phosphor bronze	250 deg. F. for 20 hr.
Hard-drawn brass	300 deg. F. for 15 hr.
Nickel silver, Monel metal	350 deg. F. for 8 hr.
Spring steel, Music wire, Stainless steel	400 deg. F. for 5 hr.

One reason why the effect of aging cannot be brought under a mathematical analysis is that the intensity of internal stresses in a given part cannot be measured directly without altering the part. For some ideal cases, the intensity and distribution can be obtained from analysis, but ordinarily, internal stress conditions are so complicated that no analysis could take all variables into account.

Although the internal stress condition cannot be analyzed readily, the effect of aging on the elastic modulus usually can be measured with little difficulty. From these measurements, it is known that aging—and indirectly, the relief of internal stresses—proceeds at a rate depending on the intensity of the internal stresses, and the temperature. Higher internal stresses introduce greater changes in the elastic modulus while higher temperatures cause more rapid stress relief. For either of these factors aging proceeds at a decreasing rate, usually logarithmic as shown in the accompanying curve, Fig. 2, for as the aging proceeds and internal stresses are relieved, there remains less internal stress and consequently less aging tendency. Theoretically, aging continues indefinitely, never reaching completion, but in most instances, the rate soon decreases to a point where further changes have no significance.

Through some crystalline mechanism not yet well understood, internal stresses set up either by cold work or quenching are almost completely relieved and dissipated rapidly at a critical temperature just below the recrystallization point. At temperatures only a little lower than this critical point, aging rates are much slower. In cold worked phosphor bronze, for example, complete relief of internal stresses takes place almost instantly at about 600 deg. F.; at 400 deg. F. more than an hour is required, and at 200 deg. F. more than two days; at room temperature it may take years. Also the time required for complete relief is greater for more cold work as shown by a paper, "Better Instrument Springs," published in the A.I.E.E. Transactions, Vol. 52, 1933, pages 869-878.

Eliminating Aging

The "cure" for aging therefore is a stress relief heat treatment that for the sake of economy should be specified at a temperature as near as possible to the annealing or softening point. In many instances, however, the maximum temperature that can be used is limited by other factors. For example, the part may be assembled with other materials such as fiber or molded composition or the part may have a finish that will not stand so high a temperature. If the part to be heat treated is already under load, the critical temperature may cause excessive set. Therefore, a compromise between a rapid treatment at high temperature, and lower temperature treatment for a much longer time is usually necessary.

Stress relief treatments given in Table III for the common spring materials, remove stiffness variations when treated for the specified time.

Since any bending or forming operation introducing plastic deformation after heat treatment will cause further stiffness variations, this stress relief treatment should follow the last forming operation.

EDITORIALS

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EDITORS

Too Large a Dose

TO ANY ONE who has made even a cursory study of the report of Secretary Perkins' Committee on Economic Security, or of the Wagner-Lewis-Doughton Bill, it should be painfully clear that the legislative dose is too large. The attempt to include within one measure a social security program for a nation as big as this one borders on imbecility, and is likely to be rejected by the patient if it is not modified.

In the very nature of things such a program must grow from experience, and this experience must be acquired over a long period of years. If we must look for precedents we have only to turn to England and Germany where social legislation has been in effect for many years, and where the results indicate clearly that neither country has come within shouting distance of a satisfactory answer to the question.

Fairness to the advisory group that worked out the principles of legislation to provide for old age, unemployment, health, and widows and orphans demands acknowledgment of the fact that they produced a workable program. But the bill drafted to carry out the program was far less satisfactory and would not have worked even had its constitutionality not been jeopardized by the introduction of the old Wagner-Lewis "club-over-the-states" principle.

As it stands now the unemployment insurance section of the bill before Congress is thoroughly unsatisfactory to almost every one, it is unworkable, and probably unconstitutional. The recommendations of the few people who have any real knowledge of the subject were disregarded, and the result is a proposal that should be fought at every point.

The old age section, on the contrary, is practically the same as the recommendations put forward by the advisers who were called in last summer and have worked on them ever since. Briefly, these recommendations provide relief for those too old to have a chance by thrift in the future to provide for themselves; for a compulsory fifty-fifty employer-employee insurance program that will encourage thrift and provide, by right, annuities for all those employed and earning less than $250 per month; and a voluntary annuity purchase plan that will permit farmers and other self-employers to buy economical government pensions or annuities for themselves.

AS FOR the remaining sections of the bill the sums of money involved are relatively so unimportant that those sections can be left for future consideration after the major issues have been met. Of these issues, the old age provisions are workable and deserve support, the unemployment insurance provisions are unworkable and deserve consistent opposition until they are made workable. The whole subject is so important and so complex that each division of it should be treated separately even if not all of them can be passed at this session. Too large a dose may kill the patient.

Loans to Industry

SOMEWHAT belatedly, perhaps, Washington has awakened to the need for stimulating industry. At least, the introduction of a bill to set up an intermediate credit corporation to finance plant modernization and machine replacement, and the moves to extend corresponding loans through FHA and HOLC point that way. The extending of such loans by RFC and the Federal Reserve has not been successful, largely because the qualified borrower would rather deal with his own bank. One of the new proposals recognizes this salient fact by including a provision to guarantee industrial bank loans up to twenty per cent.

But the pious instruction not to let thy right hand know what thy left hand doeth is being carefully observed at the Capitol. Paralleling these stimulative moves are the Wheeler measure to tax the big corporations into decentralizing themselves, and the Administration drive against the holding companies. Both of them should be quite effective in curtailing industrial purchases and stifling industrial development.

Our best hope, evidently, is that one set of moves will offset the other, thus permitting business to go ahead on at least the present level.

. CHIPS .

Washington—Federal pay cuts to be restored, but Congress must find funds with which to do it . . . Macon disaster stalls move for further dirigible building . . . Gen. R. E. Wood, head of Sears-Roebuck, appointed chairman of business advisory committee for new Works Bill . . . Senate asks for PWA data on Farley, but Ickes says there isn't any . . . U. S. Chamber of Commerce would reduce Works Bill appropriation by $2,000,000,000 . . . Richberg against two-party NRA boards, would have them in hands of neutrals to curb "civil war" . . . NRA moves to amend regulations barring bids from Henry Ford . . . Roosevelt, pleased by gold clause decision, studies means of barring damage suits against government . . . House Appropriations Committee votes nearly $380,000,000 for Army, authorizes President to increase regular army to 165,000 . . . U. S. refuses to include commercial planes in licensing limitations proposed at Geneva . . . Supreme Court gold clause decision clear evidence that there is no dictatorship in this country because even the President had no information in advance as to what it would be and when it would be announced . . . Roosevelt message asks extension of NRA for two years, clearing up of obscure points. . . . Senator Byrd advocates defeat of Works Bill on ground that recovery so far achieved makes it needless.

Foreign—Italy mobilizes forces for possible duty in Ethiopian border dispute but hostilities have apparently been avoided . . . Catholics win in Munich school vote . . . Failure of London pepper corner threatens political scandal . . . Hitler opens huge automobile show in Berlin . . . Flandin's trade revival plan wins support of French deputies . . . Philippine leaders act to curb Japanese landholders in islands . . . Germany moves to provide jobs for older men and heads of families by transferring job holders under 25 to the Government Labor Service . . . Commission of seven appointed to investigate British munition industry . . . Celebration marks achievement of 85 per cent success in collectivizing Soviet farms. . . . Purchasing power of Soviet ruble is found to be rising.

Finance—Federal holdings of securities said to be nearly $17,000,000,000 . . . SEC eases restrictions on registration of securities . . . Supreme Court, in effect, upholds Administration in gold clause cases by 5 to 4 vote, showing practical rather than legalistic attitude toward the problem . . . Markets react buoyantly in consequence . . . Sales of U. S. Treasury "baby bonds" will commence March 1 . . . Senator Wheeler offers graduated profit tax measure intended to force decentralization of big corporations . . . Establishment of a Federal intermediate credit system for business and industry, with $100,000,000 capital and authorized to issue debentures up to $1,000,000,000, with limit of $500,000 to a single borrower, is proposed in bill introduced by Representative Kopplemann . . . HOLC amendment would guarantee up to 20 per cent of loans extended by banks for industrial modernization.

Industry—A F of L orders merger of unions in automobile field . . . Demands prevailing wage for work relief project, but this provision is eliminated by Senate committee considering legislation . . . Employment at Briggs Body reaches record with 29,000 on payroll . . . General Motors starts work on new Chicago plant for building diesel locomotives . . . Wagner tries again to outlaw company unions through new industrial disputes measure . . . U. S. Steel Corporation announces plans to spend $47,000,000 for modernization of its finishing plants.

Indicators—Steel production drops still further falling below 50 per cent . . . Electric power output and carloadings practically stationary . . . *Business Week's* index recedes to 63.2.

Industrial Aid Asked For Engineering Index

An appeal has been made to the nation's industry operating in technical fields for a working capital fund of approximately $160,000 with which to continue the service now rendered by Engineering Index, Inc. It is estimated that this sum will enable continuance of the index for a period of five years, after which it is estimated that it will be self-supporting, according to an announcement by Collins P. Bliss, Dean of the School of Engineering, at New York University, and president of the Board of Directors of the Index. The A.S.M.E. voted to end its responsibility for the Index in 1933.

Herman Lind States Position on Labor

Following his testimony at the labor provisions hearing held before the National Recovery Administration, Herman Lind, general manager of the National Machine Tool Builders' Association, submitted a supplementary statement having a direct bearing on Section 7a, discussion of which was precluded at the hearing. Mr. Lind said in part:

"It seems to us that there is no justification for extending to any organization of labor, whether national, company-union or any kind, the right to sit in with representatives of industry on any matters relating to the management of industry with like authority and privileges unless such labor organizations are willing and required to submit to the same governmental supervision and participation that is accepted by industry.

"Fairness and balance would demand that this right to representation include the following stipulations:

"1. That proof be given to the government of selection of representatives in a fair and open election, free from coercion from any source, such representatives to speak only for those employees who participated in said election.

"2. That dues or assessments be subject to governmental approval as to fairness in amount and method of collection.

"3. That detailed statements of disbursements and status of funds be submitted for governmental approval.

"4. That acceptance of full responsibility for carrying through any agreements made, be covered by bond of both parties."

Business Faces New Restrictions Under Legislation Now Proposed

WASHINGTON—Although the President has stated that absorption of unemployment and restoration of a normal order of business rests in the final analysis upon private enterprise, the Administration reform policies, contrasted to those of recovery, continue unabated. Rivaling in importance the social security bill now before Congress is the promised anti-holding company legislation. Having its roots in the Administration's battle with utility interests, the present program will extend into other fields and constitute an attack on bigness as such.

Similar bills introduced by Congressman Rayburn and Senator Wheeler, chairman of the House and the Senate Interstate Commerce Committees, respectively, provide that utility holding companies must be dissolved within five years and meanwhile be under tripartite regulation of FTC, FPC and SEC. Punitive taxation provisions were not included, although it had been indicated that the way to "get" the holding companies was going to be to amend the income tax law so that they would have to pay taxes on their income from stocks and bonds with "tax paid at source," from which they and every one else is now exempted—in other words, double taxation. It has now been decided to introduce the tax provision as a separate measure. It may thus be applicable to all holding companies, not merely utilities—which means railways, steel mergers, even perhaps companies that have subsidiaries supplying the materials they use.

There are indications that two functions of the holding company may be considered legitimate and excepted. One is its financial function as an investment trust if the voting of stock is not used to influence the policies of operating companies. The other is in making available to the operating companies efficient management service and advice on a fee basis.

Another bill introduced by Senator Wheeler would penalize bigness and tend to decentralize large corporations by a direct tax on net capital returns. This measure would impose taxes ranging from a minimum of 2 per cent on a net capital return to corporations of over $3,000,000, up to 25 per cent on returns of $50,000,000 and over.

In his long heralded message on NRA the President advised extension of its major features for two years. In stating that the "rights of employees freely to organize for the purpose of collective bargaining should be protected," he reaffirmed the principle set forth in the current law but did not clarify the many interpretations given Section 7a. The foregone conclusion that price fixing is to go was definitely confirmed, and in addition, the President pointed out that small enterprises especially should be given added protection against discrimination and oppression.

Despite this sponsorship, NRA faces an inquiry by the Senate, on its own or as testimony on the bill. Senators King, Borah and McGill are in the proposed subcommittee; back of them are Nye and McCarran who introduced the resolution, presenting at the same time 21 scathing criticisms of NRA's administration. The proposed inquiry is into the "monopolistic" results of the codes and may go anywhere.

Senator Wagner's labor disputes bill will cause a lot of bitter feeling as it plans to drive directly at the company union and to remove from the President all rights to direct the National Labor Relations Board in what it takes under its jurisdiction. This bill will also seek to make majority rule compulsory.

Financing for Industry

Congressman Steagall, at the suggestion of Secretary Ickes, has introduced a bill which would provide loans to small business, both long term and intermediate. The Business Advisory and Planning Council is working hard for it on the ground that the problem of capital for small industries has been the weakest link in their organization since they cannot issue bonds to buy machinery as big units can.

Another bill, introduced by Representative Kopplemann, would set up an Intermediate Industrial Credit Corporation with twelve regional branches, a capitalization of $100,000,000 and authorized to issue government guaranteed debentures up to $1,000,000,000. Under the terms of this bill, business and industrial borrowers could secure up to $500,000 on the security of mortgages on plants and equipment, warehouse receipts, shipping documents, and "other evidences of the probability of repayment when the loan is due." Such loans could be made up to 75 per cent of the collateral.

Reciprocal Trade Pact With Brazil Signed

A wide range of American metal products will receive either a reduction of import taxes when shipped to Brazil or a guaranteed continuance of present favorable rates, according to the reciprocal agreement signed in Washington on February 2. The pact will become operative 30 days after ratification by the Brazilian government and approval of the President of the United Sttaes.

In return for continued duty free admission into the United States of coffee and other Brazilian products, which make up 90 per cent of the imports from that country, and reduction of tariffs on others, Brazil will reduce its import duties on a list of goods which includes automobiles, trucks and parts thereof, radio apparatus, certain electric batteries, spark plugs, steel furniture, steel files, certain scales, and gasoline pumps. The list of commodities to receive continued favorable customs treatment include agricultural machinery (including tractors), mechanical refrigerators, motor cycles, sewing machines, certain other domestic, office and store equipment, automatic scales, cash registers, typewriters, calculating machines, typesetting machines, and heavy radio, telephone and telegraph equipment.

Extensive Soviet Orders Placed in Great Britain

According to a recent announcement in the London *Financial Times*, transmitted to the Department of Commerce by Alfred Nutting of the American Consulate, Arcos, Soviet purchasing agency in Great Britain, announced that it had completed negotiations for the placing of large orders in that country for various machinery and equipment for shipment to the Soviet Union. The contract will involve more than £1,000,000 and will be on a cash basis.

The orders, which are to be executed over a period of from three to twelve months, are to be distributed over Manchester, Birmingham, Sheffield and Scotland. It is stated that one of the January orders, for about £500,000, is for sets of railway wheels, axles and tires complete, to be delivered in about six months.

Table I—Index of Orders, Based on Volume of Shipments for 1926

Month	Index of Orders			3 Months' Average Index	% Foreign to Total Orders
	Domestic	Foreign	Total		
1934—July	26.3	8.4	34.7	38.6	24
August	32.4	9.0	41.4	37.1	21
September	29.4	6.8	36.2	37.4	19
October	35.1	8.8	43.9	40.5	19
November	43.1	9.3	52.4	44.2	17
December	51.5	14.6	66.1	54.1	21
1935—January	52.0	13.5	65.5	61.3	20

Table II—Index of Orders—By Size of Companies

Group A—Companies reporting year's sales in 1926 of $200,000 or more:

Month	Index of Orders			No. of Reports	% Foreign to Total Orders
	Domestic	Foreign	Total		
1934—July	25.8	8.9	34.7	90	26
August	31.4	9.6	41.0	93	23
September	28.7	7.1	35.8	94	20
October	34.9	9.4	44.3	96	21
November	43.4	9.8	53.2	89	19
December	51.3	15.1	66.4	91	23
1935—January	51.6	14.3	65.9	91	22
Group B—Companies reporting year's sales in 1926 of less than $200,000:					
1934—July	33.3	1.9	35.2	82	5
August	44.7	1.0	45.7	76	2
September	39.4	3.1	42.5	81	7
October	37.5	1.7	39.2	82	4
November	38.7	2.1	40.8	82	5
December	55.6	7.3	62.9	76	12
1935—January	57.1	1.9	59.0	78	3

Table III—Distribution of Orders

(Shown by indexes of individual companies)

New Orders in % of 1926 Shipments	Number of Reports in Each Index Group						
	July	August	September	October	November	December	January
200 or more	3	6	3	5	4	9	10
100–199	9	8	12	15	15	25	21
90–99	2	5	2	3	4	5	5
80–89	3	7	5	3	4	4	10
70–79	2	3	6	6	7	6	8
60–69	12	9	2	9	9	7	10
50–59	8	12	9	12	12	18	10
40–49	13	14	15	8	16	16	13
30–39	22	18	16	19	16	14	12
20–29	29	23	24	26	17	17	21
10–19	26	27	29	31	23	24	22
Less than 10	43	37	52	41	44	22	27
Total reports	172	169	175	178	171	167	169

Budd Streamlined Trains to Be Constructed Abroad

An order for fifteen single-unit cars, each to be powered by a diesel-electric engine, has been placed by the Northern Railway of Italy and another for 30 two-car trains by the French Railways, according to a cable from Edward G. Budd, president of the Edward G. Budd Manufacturing Co. The cars will be built in Italy and France under licenses from the Budd Co., for the use of its shotweld process for fabricating stainless steel and other patents employed in the building of American streamlined trains, such as the Burlington "Zephyr" and the "Flying Yankee" of the Boston and Maine Railroad. The cost of the cars for both countries will be appoximately $3,000,000.

Chamber of Commerce Asks Work Outlay Cut

A cut of about two billion dollars from the proposed appropriation of four billion dollars for recovery and relief is recommended by the Federal Finance Committee of the Chamber of Commerce of the United States. The report points out that of the $8,500,000,000 total expenditures for the fiscal year beginning July 1 next, approximately $4,600,000,000 is for emergency purposes; that this is $300,000,000 more than was expended for the same purpose in the fiscal year 1934, and while somewhat less than the established emergency expenditures for 1935, it is still well in excess of the amount which present prospects indicate will be actually spent during this year.

Machine Tool Exports Fall; Domestic Orders Increase

A drop in machine tool export orders for January was partly offset by an increase in domestic business, making the change in total volume comparatively slight, according to the index compiled by the supervisory agency of this industry. The index of total business for January at 65.5 is actually slightly below that of 66.1 for December. However, the trend which is represented by the three months' average continues upward, with the latest figure at 61.3, contrasted with the previous average of 54.1.

Auto Production Schedules Point to Further Advances

DETROIT—Final 1934 car and truck registrations, reported by R. L. Polk Co., show that 552,780 more units were sold than in 1933. Some conception of the size of the industry in this country may be had when this figure is compared with Great Britain. During the manufacturing year ending September 30, 261,914 cars were produced, a record year.

January production reached 306,000. January sales in this country are estimated at 140,000 units from a sampling of only a few states. The spread is accounted for in dealer stocks, exports and government sales. General Motors sales in this country in January totalled 54,105 units, as compared with 23,438 units in the same month last year. Dealer sales for comparable periods were 75,727, as compared with 46,190. Ford retail deliveries totaled 75,678 units in January, exceeding the totals for both January and February of last year; domestic production of Ford cars and trucks in January reached 91,043. In this month, Chevrolet, as was the case last year, got away to a slow start with a schedule of 50,000; Olds sold at retail in January ten times the cars sold last year.

Good Prospects for March

All estimates place February production ahead of the January figure by several thousand, and March is expected to reach 400,000. The Ford Motor Co. is calling for a schedule of 140,000 in March, with Chevrolet slightly less. Large suppliers report schedules for March and April on the upgrade by better than normal; some predict a better year than 1934 by 15 per cent. Three shifts in supplier plants are prevalent, but in numerous cases more men per shift could be used were it necessary. March and April schedules are, of course, tentative and some companies are running about even with the January figure or easing off slightly. Some banks of parts are being accumulated in anticipation of possible difficulties later.

Sales of cars in Detroit for the week ending February 14 were 1,987 as compared with the previous week's total of 1,632. Sales for the week ending January 31 were 1,571.

The previous peak of power consumption at the Ford Rouge plant was reached in July, 1929; this was exceeded in the first part of February.

Doubt as to the annual show sponsorship is involved in the switch made to introduce new models near October 1 instead of at the year end. While the new introduction period overcomes the big objection of dealers to the difficulty of disposing of superseded models implicit in the staggered model plan, the period covered is yet extensive enough to present difficulties. It is the supposition that introductions will be around October 1; unless there is some general agreement on this point, the tag ends of some models will be closing out as the new offerings of other makers are being shown. Preparatory tool work on some new models for summer introduction is now going on, the plans for which antedate code renewal. To the extent that the October 1 date gains general acceptance, the 1935 season will be a short one, which doubtless helps explain the terrific rush now in progress to get cars into the dealers' hand to secure as large a share of the available spring and early summer business as possible. Symptomatic also is the reduction in prices up to $200 of one maker on models on display only a few weeks.

Latest figures released by the Automobile Labor Board show that of 60,838 ballots cast so far, 47,464 workers declared themselves unaffiliated, 5,508 belong to company unions, and 2,486 to the A. F. of L. The Federation claim that their members refrained from voting is countered by the Board's statement that "94 per cent of those who worked on the day of election voted." The latest Board elections were held at Packard and Chrysler. At the former plant 2,657 were unaffiliated, 2,131 belong to Packard employees association and 110 to the A. F. of L., a scattering belonging to other groups. At the Jefferson and Kercheval plants of Chrysler, 6,511 of the 7,067 votes were unaffiliated, 200 declared for the A. F. of L. and 68 for the employees association.

The Federation strategy is shown in the demand for an election at a large parts plant where they claim a large membership, the election to be between the Federation and the company union. This rules off the roost the M.E.S.A., the Associated Automobile Workers and others representing minority interests, tending to bring the Automobile Board's policies in conformance with those of the National Labor Board and, at the same time, running counter to the President's settlement of last

• INDUSTRIAL REVIEW •

• Having built up a moderate level of activity by steady advances from last summer's lows, machinery sales have again become hesitant. This lack of trend results from a conflict between a pressing economic need for the improved designs now available and a return of cautious buying at evidences of new legislation restrictive to business. The fresh misgivings have offset, partially at least, the removal of uncertainty in the settlement of the gold cases. Reports received from various sections of the country have no unanimity regarding latest experience in closing orders.

• Boston, for instance, finds inquiries pouring in as fast as ever but prospective customers unready to close. In New York, a better state of activity continues, although orders are confined to single items and big buying is absent. Outside of government activities, inquiries and orders in Philadelphia are below expectations; an improvement of general industrial activity, however, leads to the hope that machinery orders will follow. Good used equipment is in demand.

• Pittsburgh is encouraged by a decided betterment in general business with some orders being placed for standard machines and a few for special equipment. Some slackness is evident in Cincinnati, but this may be taken up by buying for the Air Corps and other government agencies. Permanent improvement awaits a return of confidence.

• With automotive production running ahead of adequate plant facilities, Detroit is enjoying a better volume of machinery business with prospects for a still greater demand. Chicago continues to be happy over current activity, and fears only adverse political measures. Milwaukee and St. Louis report no change. Indianapolis enjoys a fair volume of orders, but is apprehensive over the new sales tax laws.

March. Complete canvass of all automobile plans will be completed by April 15, according to present plans.

A threatened strike at the Lansing Fisher Body Plant was postponed at the insistence of Federation leaders, pending a Federation meeting in Detroit on February 23. Meanwhile a contract embodying the 30-hour week was submitted to the Fisher Body Corporation in Cleveland by the United Auto Workers Federal Union.

The Packard Company's record of employing 76 per cent of its workers for 50 weeks or more in 1934 was commended in the Research and Planning Department's report on the automobile industry released early in the month. Later it is announced that this company has agreed to a 35-hour week for tool and die makers; hours in excess of this are to be subtracted from the following week.

New developments in piston and cylinder machining are arousing interest generally; introductions will more than likely depend upon car profits in succeeding months. Interest in standard machine tools is increasing.

General Motors will build a new plant near Chicago for the production of diesel-electric railway equipment, thus bringing to successful issue the months of experimental work at the Winton plant and the Electro-Motive Corporation, the latter a subsidiary of General Motors since 1930.

Henry E. Warren to Receive Lamme Medal

Henry E. Warren, president, Warren Telechron Co., has been awarded the 1934 Lamme Medal of the American Institute of Electrical Engineers "for outstanding contributions to the development of electric clocks and means for controlling central station frequencies." Presentation will be made at the summer convention of the Institute which is to be held at Cornell University, June 24-28.

Foundrymen to Meet in Toronto Next August

Toronto, Canada, has been selected as the meeting place for the American Foundrymen's Association for its annual convention to be held August 19-23. Headquarters will be at the Royal York Hotel. The closing of the convention on Friday noon will coincide with the opening of the Canadian National Exposition.

Machine Tool Industry Leads Improvement in British Trade

MANCHESTER, ENGLAND—According to a report on the machinery trade for the fourth quarter of 1934, by Vice-Consul Myles Standish, it is estimated that production exceeded that of the third period by only 0.2 per cent and that of the first quarter by 5.4 per cent. These percentages refer to the entire engineering industry.

The high-light of domestic trade in machinery continues to be the production of machine tools. In practically all sections of the United Kingdom, in which manufacturers of this equipment are located, production ran behind demand, and few factories can effect delivery in less than twenty weeks.

The 1934 orders for textile machinery came principally from overseas, and conditions in the trade became worse during the last quarter, although silk and artificial silk machinery showed signs of improvement. The Lancashire cotton industry remained in a depressed condition and many competent observers feel that if modernization could be effected in the mills of that area, the weavers and spinners there could successfully compete with the Japanese in foreign markets. Trade in wool textiles brought orders to makers of weaving machinery for that purpose.

Steam locomotive builders at Leeds were engaged in the construction of equipment for some of the British railroads, and manufacturers there of heavy pressing and stamping machinery, machine tools (particularly, lathes, drilling machines, milling and slotting machinery), and weighing and testing machinery did well. Electrical engineering firms in that area experienced the best year of their history, producing equipment chiefly for electrification projects.

Throughout the Kingdom, manufacturers of gasoline and diesel motors passed through a period of activity and were occupied principally with the production of motors for highway transportation, such as buses and heavy-duty trucks. Electrical equipment manufacturers did well during the last quarter, and the industry concentrated upon the exploitation of the industrial motor market and produced a quantity of electric street cars. An interesting note is that of the delivery, during the last quarter, by a Glasgow firm of one of the world's largest lathes, which was 143 ft. long.

From the accompanying table, it will be seen that the total exports of machinery during 1934 increased in value by 18.8 per cent over those of 1933.

San Diego to Hold Pacific Exposition

On May 29, the California Pacific International Exposition will open at San Diego and remain in operation until November 11. The buildings and grounds of Balboa Park will provide an ideal site.

The committee in charge of this exposition estimates an attendance of between five and ten million visitors and plans to make it a worthy successor to a Century of Progress held in Chicago in 1933 and 1934.

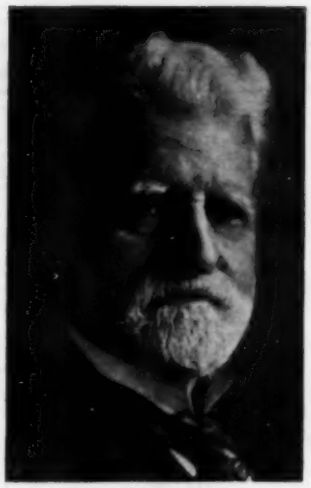
Principal Exports of the United Kingdom During 1934

(Volume is expressed in tons of 2,240 pounds and value in Pounds Sterling)

	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Electrical machinery	8,687	£1,323,672	3,683	£488,362	14,376	£2,116,400	10,704	£1,640,032
Machine tools	2,066	263,886	2,451	425,660	3,602	483,290	3,185	445,221
Mining machinery	3,241	266,333	3,739	299,887	3,693	308,431	8,094	637,738
Motors	9,382	630,424	8,815	672,877	9,335	730,171	8,678	794,838
Textile machinery	20,628	1,566,198	20,339	1,744,924	17,652	1,581,891	19,872	1,777,203
Totals	44,004	£4,050,513	40,027	£3,631,710	48,658	£5,220,183	50,533	£5,295,032

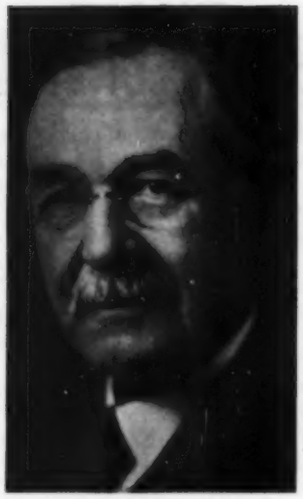
Principal Imports Into the United Kingdom During 1934

	First Quarter		Second Quarter		Third Quarter		Fourth Quarter	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Refrigerating machinery	1,322	£149,055	1,155	£144,129	561	£82,996	401	£69,286
Machine tools	1,324	302,635	1,595	333,255	1,858	379,289	1,787	400,429
Office machinery	195	100,448	202	121,467	228	94,084	108	110,951
Printing and bookbinding machinery	638	156,875	700	194,064	811	197,846	873	196,057
Textile machinery	1,084	248,030	1,530	280,391	1,369	268,227	1,314	268,598
Totals	4,563	£957,843	5,182	£1,073,306	4,827	£1,022,422	4,483	£1,045,321



AMBROSE SWASEY

H. D. TANNER



C. S. FARQUHAR

1935 Washington Award Goes to Ambrose Swasey

Ambrose Swasey, 88-year-old chairman of The Warner & Swasey Co., is the recipient of the Washington Award for 1935, which was founded eighteen years ago by John W. Alvord. The award was made at a dinner by M. C. Whittier, president, Western Society of Engineers; Professor Philip Fox, director of the Adler Planetarium, delivered the principal address which dealt largely with Mr. Swasey's accomplishments in connection with the building of telescopes and turret lathes.

H. D. Tanner Appointed Machinery Manager

Among the promotions in the Pratt & Whitney Co., recently announced by Clayton R. Burt, president, was that of H. D. Tanner, who has been advanced to the position of manager of the machinery division. Mr. Tanner, who is a graduate of Brown University, has been with the organization for fifteen years.

At the same time Edward J. O'Malley was appointed superintendent of all manufacturing divisions in both the machinery and Keller divisions. Alden M. Drake, formerly chief engineer, now assumes charge of a department being formed for the development of machines and tools for the manufacture of P. & W. small tools.

Carroll Knowles, formerly a designing engineer, was made chief engineer of the machinery engineering department. R. F. V. Stanton has been appointed research engineer of the engineering division, and Eugene Sullivan has been promoted to general foremanship of all manufacturing in Building 4 of the machinery division. The Keller division will have a new general foreman in B. G. Denlinger.

• PERSONALS •

J. J. Baker has been elected president and general manager of the Safety Grinding Wheel Machine Co., Springfield, Ohio. Mr. Baker has also been re-elected to the code authority of the Grinding Wheel industry.

Athel F. Denham, formerly Detroit editor of the Chilton Company, publishers of automotive journals, has formed an automotive technical advisory service on advertising and publicity, with headquarters at 1235 Lafayette Bldg., Detroit.

H. C. Guild has been made manager of the Eastern Division of the Vilter Mfg. Co., Milwaukee, Wis., manufacturer of refrigerating and air conditioning machinery and steam engines. Mr. Guild was formerly with the A. M. Byers Co., Pittsburgh, Pa.

Arthur D. Morris has been elected president of the Bayonne Bolt Corp., Bayonne, N. J., to succeed Ernest L. Rupp, who has retired. A vice-president since 1927, Mr. Morris started with the company as a salesman in 1912.

Lambert H. Vervoort has been elected president of the Vervoort Mfg. Corp., Falconer, N. Y., manufacturer of ball-bearing casters and metal products.

Frank A. Livingston, formerly vice-president and treasurer of the Ralston Steel Car Co., Columbus, Ohio, has been named president and general manager, succeeding the late Francis E. Symons, who died Jan. 23.

Charles Wesley, Sr., was reelected president and general manager at a recent meeting of the Wesley Steel Treating Co., Milwaukee, Wis. Charles I. Wesley succeeded Frank Marks as vice-president and works manager. The new building program was also announced.

• OBITUARIES •

Charles S. Farquhar, 80, president and treasurer of the Lynd-Farquhar Co., Boston, Mass., machine tool dealers, died Feb. 8. Mr. Farquhar was a past-president of the National Supply & Machinery Dealers' Association. In 1879 he organized the firm of Chandler & Farquhar, and remained as treasurer until 1906, when he became president on the death of Mr. Chandler. In 1917, he formed the Lynd-Farquhar Co., and acted as treasurer until 1925, when on the death of Mr. Lynd he became president.

V. V. Carr, general superintendent, Diamond Machine Co., Pittsburgh, Pa., died Feb. 10, at Monongahela, Pa.

J. Lee Rodgers, 57, vice-president and treasurer of the National Valve & Mfg. Co., Pittsburgh, Pa., died recently.

Frederick W. Vilmar, 53, a co-founder and vice-president and treasurer of the American Stamping Co., Cleveland, Ohio, died in that city Feb. 18, after a long illness.

Lewis Walker, Jr., 53, vice-president of the Hookless Fastener Co., Meadville, Pa., died suddenly Feb. 11. He joined the company in 1915 and had served as vice-president since 1919.

• EXPORT • OPPORTUNITIES

Aluminum, brass and copper kitchen utensil, and milk can and pail manufacturing machinery, and bottle making machinery. 8450.*

Agricultural machinery, such as seeding equipment, cutters, and cylinder mills. 8471.* Turin, Italy.

Engineering equipment, tools, parts and accessories. 8470.* Wellington, New Zealand.

Leather-gasket making machinery. 8468.* Paris, France.

Metal-working and wood-working machinery, and paint spraying machines. 8435.* The Hague, Netherlands.

Paper-bag making machinery. 8461.* Nuevo Laredo, Mexico.

Riveting machines to punch and rivet handles on aluminum ware. 8472.* Tel Aviv, Palestine.

Toilet paper manufacturing machines for crimping, slitting, perforating and rewinding paper. 8445.* London, England.

Trucks, lift. 8451.* Amsterdam, Netherlands.

*Interested American firms and individuals may obtain the names and addresses of the foreign firms making these inquiries upon application to the Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, or any district or cooperative office.

• MEETINGS •

AMERICAN MANAGEMENT ASSOCIATION. Fifth packaging conference and exposition, March 5-8. Palmer House, Chicago. Joint conference of the Job Order and Mass Production Divisions, April 18-19. Hotel Statler, Cleveland. American Management Association, 20 Vesey St., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Machine Shop Practice Meeting and Exhibit, afternoon and evening, March 28. Engineering Bldg., 205 W. Wacker Drive, Chicago. C. B. COLE, chairman, 4625 Fulton St.

PACKAGING MACHINERY MANUFACTURERS INSTITUTE.—Semi-annual meeting, March 7, 6:30 P.M., Palmer House, Chicago, H. L. STRATTON, secretary, 342 Madison Ave., New York.

WELDING CONFERENCE. Fourth annual welding conference conducted by the department of industrial engineering, Ohio State University, Feb. 28-Mar. 1, at Industrial Engineering Building. Address Asst. Prof. O. D. RICKLY, Ohio State University, Columbus, Ohio.

Corporation Reports

Company	1934 Earnings	1933 Earnings
Allis-Chalmers Mfg. Co.	*d*$1,039,406	*d*$2,893,905
Altorfer Bros. Co.	$100,310	$237,415
Automatic Washer Co.	*d*$104,228	$10,908
Baldwin Locomotive Works	*d*$3,698,494	*d*$3,857,743
Brill Co., J. G.	*d*$103,214	*d*$1,020,367
Brown Instrument Co.	$110,096	$314,582
Chicago Electric Mfg. Co.	$67,007	$21,534
Chicago Flexible Shaft Co.	$368,040	$189,515
Cockshutt Plow Co., Ltd. (Canada)	**d$525,937	**d$869,732
Consolidated Machine Tool Corp. of America	††$286,835	
Crosley Radio Corp.	*$578,477	*$344,452
Defiance Spark Plug Corp.	**d$61,179	**d$79,427
Dresser Mfg. Co., S. R.	$112,218	$45,606
Foote-Burt Co.	*d*$109,905	*d*$104,286
Fosteria Pressed Steel Corp.	$11,664	$914
General Motors Corp.	$94,769,000	$83,213,676
General Railway Signal Co.	*d*$342,150	*d*$24,119
Great Lakes Engineering Works	$291,217	$94,505
Greenfield Tap & Die Corp.	$85,835	*d*$13,473
Helme Co., George W.	$1,988,887	
Holland Furnace Co.	*†$337,484	*$159,105
Houdaille-Hershey Corp.	$931,400	*d*$113,899
Leland Electric Co.	$59,679	$91,380
Lycoming Mfg. Co.	**d$547,203	**d$592,996
Landis Machine Co.	$74,111	*d*$76,730
Mateor Motor Car Co.	*d*$9,779	*d*$5,618
McCord Radiator & Mfg. Co.	*d*$27,509	$24,757
Minneapolis-Honeywell Regulator Co.	$1,007,785	$869,732
Modine Mfg. Co.	$228,525	$45,251
Motor Wheel Corp.	$409,673	$122,168
Murray Corp. of America	*d*$363,229	$792,851
National Sash Weight Corp.	*d*$74,194	*d*$78,622
Parker Rust Proof Co.	$691,067	$403,958
Pittsburgh Screw and Bolt Corp.	$203,147	*d*$143,700
Ross Gear and Tool Co.	$248,476	$139,091
Servel, Inc.	$521,518	
Stutz Motor Car Co.	*d*$246,545	*d*$457,826
U. S. Hoffman Machinery Corp.	$44,376	*d*$299,353
Wayne Pump Co.	*d*$38,982	*d*$319,657

d—Deficit.
*—Nine months ending Dec. 31.
**—Year ending Nov. 30.
†—Before Federal taxes.
††—Eleven months ending Nov. 30.

• PATENTS •

February 12, 1935

Metal-Working Machinery

Multiple Spindle Machine. William J. Bryant and Merton H. Arms, Springfield, Vt., assigned to Bryant Chucking Grinder Co. Patent 1,990,469.

Machine for Making Sheet Metal Containers. Frank Edward Adams, Lower Bebington, and Leonard Faviell Gee, Great Crosby, England. Patent 1,990,579.

Punching and Riveting Machine. Lee L. Marchant, Lincoln Park, Mich. Patent 1,990,998.

Assembling Machine for Thin Metal Sheets. John Christie and Newton B. Green, Rochester, N. Y., assigned to Eastman Kodak Co. Patent 1,991,138.

Tools and Attachments

Machine Tool. Robert E. Wiley, Rockford, Ill., assigned to The Ingersoll Milling Machine Co. Patent 1,990,509.

Centrifugal Chuck. Philip M. Chancellor, Chicago, Ill. Patent 1,990,525.

Tool Carrier for Metal Working Machines. Myron S. Curtis, Pawtucket, R. I., assigned to William Wallace Potter. Patent 1,990,527.

Rotary Cross Cut Tool. Robert S. Brown, New Britain, Conn., assigned to the New Britain-Gridley Machine Co. Patent 1,990,724.

Expansible Honing Tool. Leonard W. Johnson, Batavia, Ill. Patent 1,991,220.

Machine Tool With Rotary Tool. Herbert Lindner, Berlin, Germany. Patent 1,991,285.

February 19, 1935

Metal-Working Machinery

Press for Cutting Metal and Other Sheets. Harry Albert Griffiths, Edgbaston, Birmingham, England. Patent 1,991,457.

Machine Tool and Attachments Therefor. Henning A. Eklind, Chicago, Ill. Patent 1,991,500.

Grinding Machine. Frederick J. Theler, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,991,712.

Grinding Machine. George W. Binns and Clement Booth, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,991,724.

Grinding Machine. Alfred G. Plimmer, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,991,771.

Grinding Machine. Sol Einstein and Clement Booth, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,991,799.

Grinding Apparatus. Halvor F. Holbeck, Columbus, Ohio. Patent 1,991,899.

Machine Tool Having Fluid Pressure Feeds. Alexander Groundwater Walls and Rognvald Nicholas Walls, Ashton on Mersey, England. Patent 1,991,915.

Electrically Controlled Screw-Cutting Machine. Richard Herrmann and Ernst Herrmann, Stuttgart, Germany. Patent 1,991,927.

Grinding Machine. Lester F. Nenninger, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,991,953.

Grinding Machine. Millard Romaine, Cincinnati, Ohio, assigned to Cincinnati Grinders Incorporated. Patent 1,991,958.

Tools and Attachments

Indexing Mechanism for Automatic Multiple Spindle Screw Machine. Alfred E. Drissner, Cleveland, Ohio, assigned to the National Acme Co. Patent 1,991,382.

Thread Cutting Tool. Frank P. Dempsey, Detroit, Mich. Patent 1,991,494.

Die Head. James Hervey Sternbergh, Reading, Pa. Patent 1,991,636.

Tool Driving Mechanism. Ernest J. Lees, Cleveland, Ohio, assigned to the Lees-Bradner Co. Patent 1,991,754.

Fluid Operated Grinding Tool. Harold V. Lovgren, Boston, Mass., assigned to Henry T. Nelson. Patent 1,991,764.

High Speed Turning Bit, Milling Tool, and Similar Tool, and Process for Manufacturing the Same. Leo Kluger, Vienna, Austria. Patent 1,991,805.

Broaching Apparatus. Robert K. Hopkins, New York, N. Y., assigned to M. W. Kellogg Co. Patent 1,991,937.

Electrical Sizing Device. Clarence J. Green, Worcester, Mass., assigned to Norton Co. Patent 1,992,027.

American Machinist
REFERENCE BOOK SHEET ©

Roller Bearing Assembly Methods

Bearing applications may be broadly divided into two main groups; namely, rotating and stationary shafts. Both groups have characteristic details of assembly, according to Paul Haager, Engineering Department, The Timken Roller Bearing Company, Canton, Ohio.

Because of the tapered construction, Timken bearings may be set to the correct running clearance after the other parts have been assembled. Likewise, it is not necessary to hold certain dimensions to particularly close limits. For example, width tolerances of 0.020 to 0.030 in. can be permitted in the machine work by making provision for this variation in bearing adjustment. A shaft finished 0.001 in. larger than specified or a hole machined 0.001 in. smaller does not require additional machining to correct the error. The bearing races can be assembled without anticipation of trouble, as the correct running clearance of the bearing is established by setting the cup and the cone.

In Fig. 1, dimensions *U* and *V* can each vary 0.010 to 0.015 in. Machine work for two opposed bearings can therefore have total clearances of 0.040 to 0.060 in., and be speeded up by the use of machine stops to gage shaft shoulder width measurements or housing bore depth measurements. Correct alignment of cone and cup seats, however, is essential.

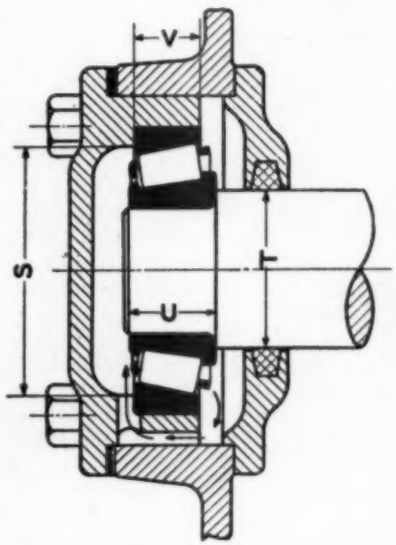
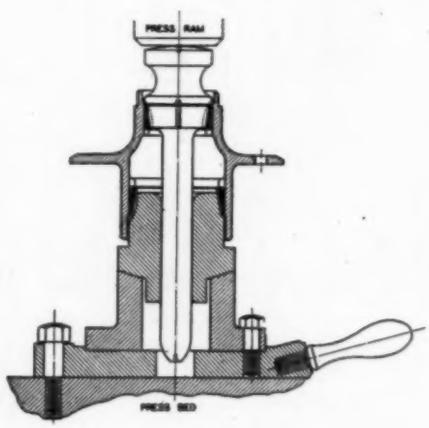


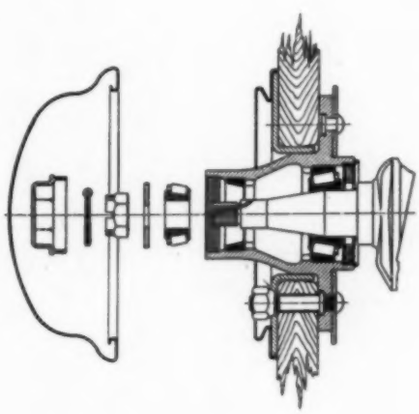
Fig. 1—The adjustable feature of this tapered roller bearing compensates for variations in machine work

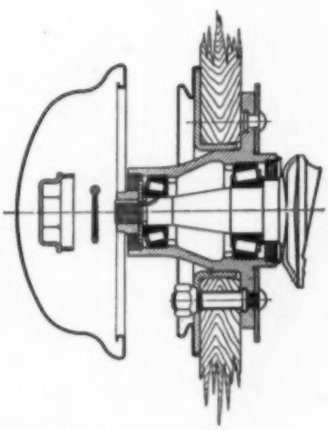
When speeds do not exceed 500 r.p.m., cones may be loosely mounted on stationary shaft applications such as automobile and tractor front wheels, shop truck and farm implement wheels. Where alloy steel or high-grade heat-treated spindles are used, the fit may vary from 0.0002 in. loose to 0.0012 in. loose in the case of the small size bearings and from 0.0002 in. loose to 0.0017 in. loose in the larger sizes. When ordinary carbon steel is used, a fit of 0.0000 in. tight to 0.0020 in. loose is recommended.

As speeds increase, fits should be closer, and where they run from 500 to 1,000 r.p.m., small bearings may be set from 0.0005 in. tight to 0.0005 in. loose, and larger ones from 0.001 in. tight to 0.001 in. loose. For speeds above 1,000 r.p.m. cones should be fitted about 0.0005 in. tight per in. of shaft diameter. Cups almost always require a tight fit.

The assembly of automobile front wheels is typical of stationary shaft







Assembly of automobile front wheels is typical of stationary shaft applications. Fig. 2—Pressing the cups into the hub. Fig. 3—Sequence of the assembly. Fig. 4—Ready for final bearing adjustment

Roller Bearing Assembly Methods

applications, and Figs. 2, 3, and 4 illustrate the methods involved. In Fig. 2, two bearing cups are pressed into the wheel hub with one operation by means of a special fixture. The fixture is so designed that the cups will be pressed into place squarely, assuring proper alignment, and arranged so that the pressure is exerted upon the face rather than on the tapered bore of the cups. It is important that the cups be seated square and solidly against the shoulders, and a feeler gauge should be used to check this point.

Fig. 3 shows the sequence of assembly of the various parts on the shaft, and Fig. 4 illustrates the assembly ready for final bearing adjustment. The nut is drawn up against the outer cone and the wheel rotated in both directions until the pressure of the nut causes a noticeable bind in the bearings, which indicates that all parts are properly seated. It is then backed off a fraction to permit free operation without end play.

General applications should have from 0.001 to 0.005 in. end play, which in the case of most wheel applications is scarcely perceptible. Ordinarily approximately 3/32 in. should be allowed for shim or thread adjustment. Final adjustment in the case illustrated is made by backing off the nut to the nearest castellation where the bearings run freely, and then locking it with a cotter pin.

Transmissions for automobiles, trucks, tractors, and machine tools, represent typical examples of the application of Timken bearings to rotating shafts. Assembly methods necessarily vary widely in this type of application, but Figs. 5 and 6 illustrate certain problems frequently encountered in this type of application.

The cone fit on the shaft is particularly important in applications of this type, especially when speeds are high or loads severe. Heavy loading requires a tight press fit regardless of whether bearing adjustment is made through the cone or the cup. Ordinarily, a normal press fit of 0.0005 in. per in. of shaft diameter will be satisfactory.

Bearing cups are usually stationary in rotating shaft applications, and ordinarily an adjustable fit will prove satisfactory. Up to 5 in. outside diameter cups should be fitted from 0.001 in. loose to 0.001 in. tight, and above that size from 0.002 in. loose to 0.001 in. tight. Special precision applications, however, require special fitting.

Fig. 5 illustrates the first step in assembling Timken bearings on a rotating shaft such as is found in a gearbox. Limited space makes it necessary to first place the gear and lower bearing cones within the box, where they are held in place by a suitable fixture. The shaft is then forced through the gear and lower cone by means of a press ram as shown.

In Fig. 6 the lower bearing has been assembled in place and the cup of the upper bearing is being forced into position. The press ram should be brought down until the bearings begin to show a slight bind while being rotated. The space between the upper cap flange and the housing should then be measured with a feeler gauge. To this measurement from 0.003 to 0.005 in. should be added as the required shim thickness. Following this the upper cap can be bolted in position.

Disassembly is equally easy if the simple precaution of applying the pressure direct to the bearing cone is followed. Provision is always made for either pressing the bearing out or attaching a bearing puller, thus avoiding the possible danger of damaging the bearing or shaft by knocking the bearing free from the shaft or housing.

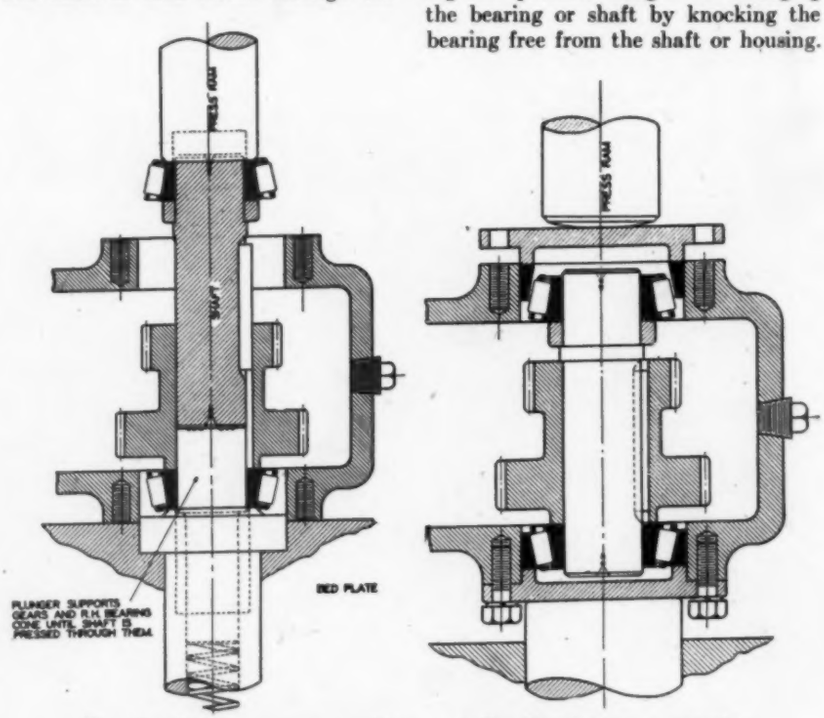


Fig. 5—First step in assembling a roller bearing on a rotating shaft. Fig. 6—Forcing the cup of the upper bearing in position

Fooling the Machine Bootlegger

JOHN R. GODFREY

Bill Grimes was mad. And because he and Old Man Johnson were friends of long standing he was glad to find young Tom in the office instead of his Dad.

"I've always supposed Tom, that you Johnsons had engineers who could design things that would work," said he, trying to be as dignified and polite as possible.

"Most people think so, Mr. Grimes. Fact is I've heard you compliment us several times, some years ago to be sure, on that very thing."

"Well, somebody pulled a boner this time, Tom, and it's cost us plenty. Seems to me you ought to make good, when the fault is in your own design."

"Just what's the trouble, Mr. Grimes? We haven't built you any machines for several years. Not since you got that new shop super and put in all your flossy systems. We've bid on several orders but have always been told by the new P.A. that our price was too high—only he used a lot of adjectives that don't look well on paper."

"But we've just built a special machine that Wilson said was from your designs. It cost over three thousand dollars and it don't work. What's the answer to that?"

"I can guess the answer, Mr. Grimes, but let's ask our engineer, Jack Green, about it."

"Jack," said Tom, when Green appeared, "Mr. Grimes says his men built a machine from our designs and it doesn't work. Did we sell him any designs, Jack?"

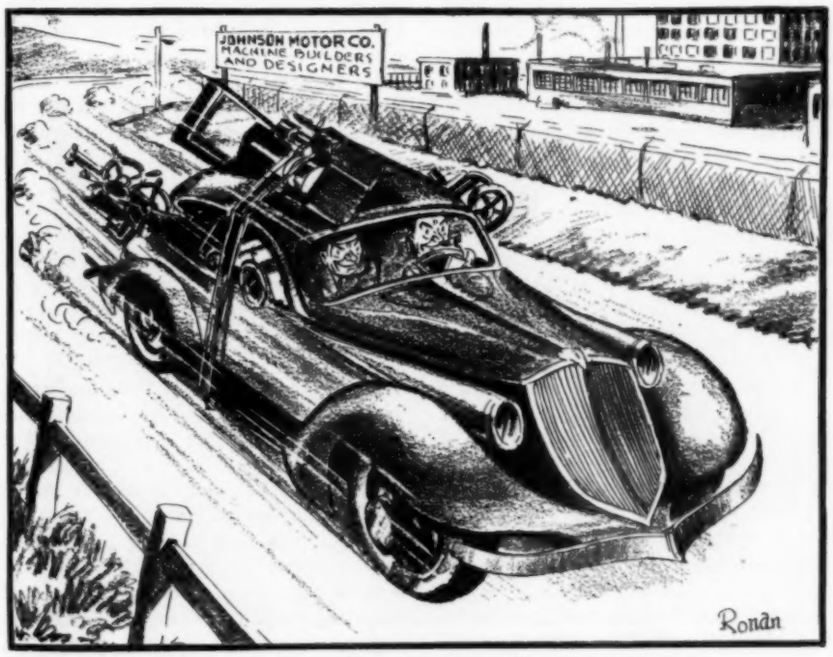
"Hardly, Tom. Mr. Grimes' super, Wilson, doesn't buy designs, or machines either. He's a grand bootlegger when it comes to getting machines built. He asks for bids and designs, but he either builds the machines himself or farms them out to some cheap shop that couldn't design a lemon squeezer. Not having any cost for designing, and often owing everybody in town, besides, they bid low and get the work."

"What sort of a machine was it, Mr. Grimes?" asked Tom.

"Some sort of a cam cutter, I believe."

"Know anything about it, Jack?" asked Tom.

"Guess I do, Tom. So do you, if you'll recall our confab about six months ago."



Look out that the machine bootlegger does not steal your designs from an unsuspecting or complacent customer

"I get you, Jack," and Tom laughed, too.

"What's funny about my losing a couple of thousand dollars or more?" fumed Grimes.

"Well, I'll tell you, Mr. Grimes. We've been bidding on special machines for you for several years. Haven't got an order. But we know our designs have been used, as Jack has told you. So when this request came in we decided to try an experiment to see just how much your engineers knew about special machines.

"Knowing from past experience that we wouldn't get the order, we designed a machine that we knew wouldn't work, to see what would happen. Your engineers either didn't look the drawings over, or are shy on ability. We wanted to see if some of the shops you've been patronizing knew enough to catch the error, as we were pretty sure your men wouldn't. But when Wilson decided to build the machine himself he made you the goat as well as himself."

"Do you mean to tell me, Tom, that we've been using your designs without paying for them? I've wondered why you didn't build machines for us as you used to. I don't blame you for putting up a job on us. Seems like I ought to pay you for those we've used that worked."

"Guess not, Mr. Grimes. We'll sort of square it with your loss this time. Perhaps it wasn't just in line with the last word in ethics, but it got under our skins after a while and we'd decided not to bid again anyhow."

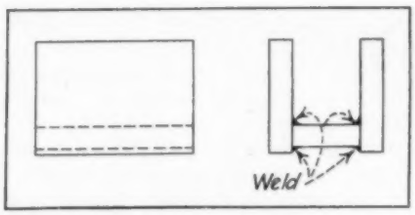
"I don't enjoy eating crow a darn bit, Tom, but we had it coming, even if I didn't know it. Wilson and the P.A. have got to have better alibis than I can think of to hold their jobs after this. Know any really good men I could hire, Tom?"

What Do Jigs and Fixtures Cost?—Discussion

NILS H. LOU

The article under the title given above (*AM*—Vol. 78, page 706) must have been of great interest to all shop managers and toolmakers who have read it. However, it appears to me that the time allowed for making the tools is rather high. I refer especially to the jigs shown in Figs. 1 and 2 and the fixture in Fig. 3.

The drill jig in Fig. 1 could be made in 11 hr. as indicated by the times given for the operations in Table I. The three holes in detail *1* can be drilled and reamed in the jig borer within the required limits, no boring being necessary.



Welding three pieces of cold-rolled steel to make this jig body will save the time of making a pattern and a casting

The toolroom work consists in drilling and tapping one hole for detail *9*, drilling and reaming four holes for detail *11*, and one hole for detail *5*, all of which should not take more than 1.5 hr. For detail *3* I have allowed 0.75 hr. for milling the undercut and the groove, and 0.75 hr. for bench work, which consists of drilling three holes for the slot, breaking the webs between the holes with a cold chisel and rounding the corners with a file. Detail *4* can easily be made in 0.75 hr. By making detail *8* a press fit in detail *1*, the threading and tapping will be eliminated. The allowance of 0.75 hr. for making the four feet is very liberal. In our shop we consider the feet standard parts and make them in lots of 100, the time being 1 min. each.

Though we have never made a jig exactly like this one, we have made many jigs of similar design, the time for which has often been less than 8 hr. each.

I think the time allowed for making the jig in Fig. 2 is also very liberal. The casting could be eliminated by electric welding three pieces of cold-rolled steel, as shown in the accompanying sketch. The time for cutting off, preparing for welding, and welding would be about 1.5 hr. Compared with the allowance of 8 hr. for making a pattern, this means a saving of 6.5 hr., to say nothing of the time in making the casting.

The fixture shown in Fig. 3 could also be made by welding, the time being about as given in Table II. This is much less than the 7 hr. allowed for the pattern alone. If the job were a rush one there would be no such delay as would be caused by having to make a pattern and a casting.

Table I—Drill Jig

Cut off material	0.50
No. 1. Boring department	1.00
Toolroom	1.50
No. 2.	0.75
No. 3.	1.50
No. 4.	0.75
No. 5.	0.50
No. 8.	0.50
No. 11.	0.75
Hardening	0.75
Assembling	1.50
Inspecting	1.00
Total, hr.	11.00

Table II—Fixture

Cut 1-in. boiler plate to 11⅜ in. diameter, using an acetylene torch	0.50
Cut off 7½-in. round cold-rolled steel 2½ in. long, face on side and bore 4 1/16-in. hole	1.75
Cut off three pieces of 1½x2-in. flat cold-rolled steel 2 5/16 in. long	0.50
Welding	1.25
Total, hr.	4.00

Finding the Diameter Where the Center Is Not Accessible—Discussion

WM. S. ROWELL

A number of excellent articles under the title given above have appeared in *American Machinist* from time to time —the latest by Matthew Harris for calipering segmental gear blanks (*AM*—Vol. 78, page 580) is of interest mostly because an instrument having the obviously superior principle of tangential contact is employed. It is easily made and it continues to hold its accuracy indefinitely. If, however, the depth gage is fixed below the apex, as shown, a cylinder, or disk, of known diameter must be used as datum.

The several contributors have described different forms of instruments and have given a number of formulas for their use, some of which are simpler than the well-known formula,

$$\text{diameter} = \frac{\frac{1}{2}\ \text{chord}^2 + \text{height}^2}{\text{height}}$$

Computation is much simpler when an instrument having tangential contact is used, especially if the chord it spans is 120 deg., in which case calculation almost disappears, since the required diameter is twice the depth-gage measurement.

Apparently the best known form of instrument for the purpose is a rectangular yoke that contacts the segment with 90-deg. knife edges. The difficulty of maintaining these sharp edges is a strong argument in favor of an instrument employing tangential contact. Because the yoke-type instrument may be used on any segment, no matter how great its radius, there is a tendency to use it where the radius is so great as to leave accurate results wholly out of reach. If, as has been recommended, a 4-in. yoke is used on a segment of 8-in. radius, subtending an arc of 28 deg. 57 min. 18 sec., an error of 0.001 in. in depth-gage measurement means an error of almost exactly ⅛ in. in diameter. It seems strange to me that none of the contributors has emphasized the truth that even approximate accuracy cannot be expected if the chord spanned is less than 120 deg., and that an accurate and skillfully handled instrument must be used.

The instrument described by Charles Kugler (*AM*—Vol. 78, page 790) in which any plane surface and two cylinders supply all the equipment necessary, has high merit, but is slow in operation. Not the least of its merits is that it employs no depth gage, with its difficult and doubtful results, and no knife edges. However, I would suggest that one of the many so-called liquid solders would be convenient for holding the cylinders while the micrometer measurement is taken.

The solution of the problem by proportion by Elmer Olson (*AM*—Vol. 78, page 420) is simple enough for any machinist. Accurate results in any and all proposed methods depend upon using an arc of 120 deg. or more, and upon accurate instruments used by a competent man.

What Is a Spiral Spring? Discussion

PAUL C. BRUHL

In reply to the question under the title given above (*AM*—Vol. 78, page 508), permit me to quote *Webster's Dictionary:* "A spiral is the path of a point that moves in a plane around an axis while continuously receding from or approaching it." "A helix is a curve formed on any cylinder by a right line in a plane that is wrapped around the cylinder, as an ordinary screw thread."

Thus there is a distinct difference between a spiral and a helix. A spiral can be developed only in a plane. The spiral traced by a moving point extends into the second dimension only. A helix, however, extends into the third dimension. The term spiral can not be applied to a spur gear having teeth at an angle to the axis; such a gear is a helical gear.

A clock spring and the scroll plate of a chuck are true spirals. A man holding a string attached to a pole and walking around the pole is traveling in a spiral path. If a man walks up a winding stairway, he follows a helical path.

A taper spring, as a bed spring, a tapered hob or a pipe tap embody true helices. The varying diameters of the coils of a taper spring do not impair the definition of a helix, since the course of the coils extends into the third dimension. If a right line is wrapped around a cone, a tapered helix will be formed. If a tapered spring is pressed flat, that is if all its coils are forced into a plane, it becomes a spiral spring. Its helical curve has been forcibly changed into a spiral path.

IDEAS

FROM • PRACTICAL • MEN

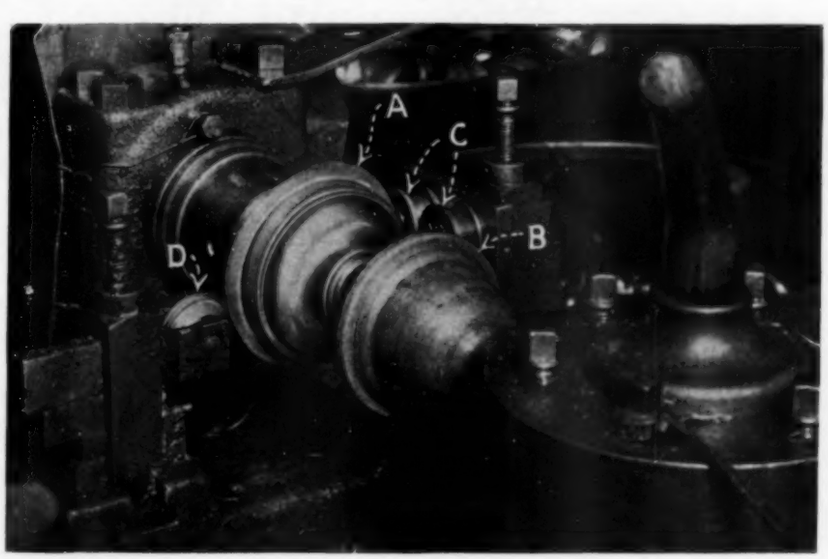
Finishing Drawn Work in the Turret Lathe

LEONARD CHURCH

To most mechanics the turret lathe is a machine tool for the production of parts by removing metal in successive operations from bar stock. But to Paul Pfeiffer, superintendent J. C. Virden Co., Cleveland, Ohio, the turret lathe is a handy tool around the shop that can be adapted to turn out many jobs more quickly and more cheaply than could be done by the usual methods.

One job, for example, is trimming and beading the flanges of fittings for holding diffusing globes for electric lighting. Referring to the illustration, the work *A* is held in the aluminum cup *B*, which is mounted on a ball-bearing shank held in the turret, and is driven by a plug in the spindle bearing against a disk inside the fitting. Rotary shears *C* held in the rear toolblock trim the irregular edges of the flanges, then the beading tool *D* in the front toolblock curls the edges over in a tight bead, making them smooth. Production is at the rate of from 650 to 900 per hr., depending upon the size.

The turret lathe is also used for putting internal beads on lighting units that hold both the lamps and the diffusing globes. They are drawn and pinch trimmed in a press and are then put in the turret lathe and internally beaded at the rate of 400 per hr. The examples given are but two of a score or more unusual uses to which the turret lathe is put in this shop for reducing costs and producing better articles.



The irregular flanges of drawn, electric lighting fittings are trimmed and beaded over in the turret lathe by the use of inexpensive tools

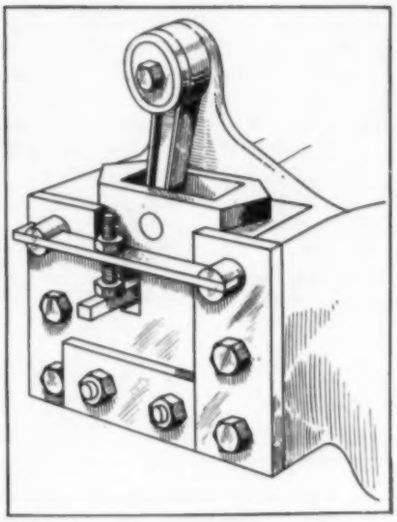
Knockout Operating Bar for the Upper Die

CHARLES H. WILLEY

We have just added to all of our small Yankee type bench presses a knockout arrangement that can be adapted to many makes of presses of a similar type.

As shown in the sketch, a slot is machined in the ram just below the wristpin, and in this slot is put the knockout bar, the rear end of which is pivoted to the back of the ram. A hole is drilled in the ram directly under the bar to accommodate the stripper pins.

Across the front of the ram guide and secured in the slots of two special slot-head screws is a bar holding an adjustable screw for timing the knockout. It will be readily understood that as the ram ascends, the projecting end of the knockout bar contacts with the head of the adjusting screw, depressing the bar and operating the knockout.



The knockout arrangement illustrated has been applied to a battery of small bench presses. It is simple, efficient and easy to adjust

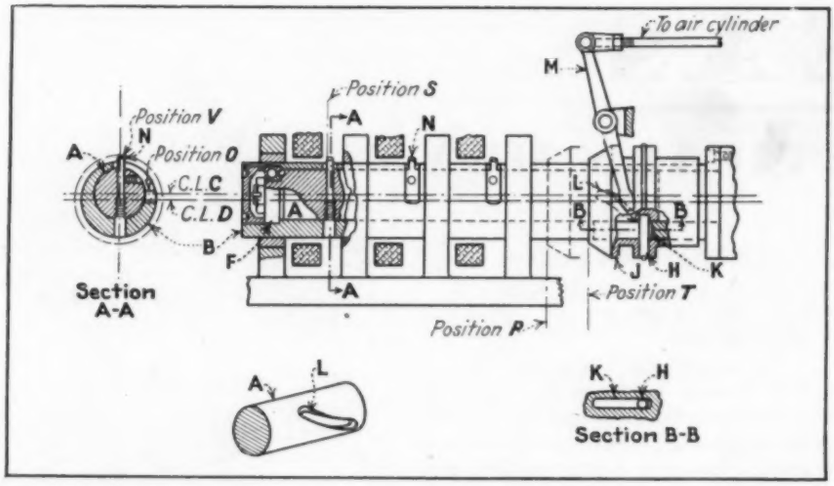
A Multiple Boring Tool

PETER F. ROSSMANN

The illustration shows a tool for boring three capped bearings simultaneously. All the bearings are bored to the same diameter, eliminating the customary stepped diameters in setups for multiple boring.

The cutter bar *A* is eccentrically located in the drive bar *B* on center line *C*. Center line *D* indicates both the center line of the drive bar and that of the diameter to be bored. The cutter bar is located axially in the drive bar by bearing *F*. Pin *H* in sleeve *J* extends through slot *K* in the drive bar and engages the helical groove *L* in the cutter bar. The forked shifter lever *M* imparts sliding movement to sleeve *J* by means of a double-acting air cylinder (not shown) attached to the spindle head of the machine.

In operation, the boring bar enters the fixture bushings without revolving and with cutters *N* in position *O* and sleeve *J* in position *P*. Due to the eccentric location of the cutter bar in



A pin in the sleeve engages a helical groove in the cutter bar. When the sleeve is moved axially the cutter bar is rotated, bringing the cutters either above or below the surface of the drive bar

the drive bar, the ends of the cutters, when in position *O*, are below the surface of the drive bar.

After the cutters have cleared the fixture bushings at position *S*, a cam-operated air valve (not shown) controls the air cylinder and causes lever *M* to slide sleeve *J* from position *P* to position *T*, rotating both the cutter bar and the cutters from position *O* to position *V* by means of pin *H* in the helical groove *L*. At this point the boring bar begins to revolve and to feed. At the end of the cut the machine spindle stops and the bars are withdrawn. As the cutters approach position *S*, the air cylinder returns sleeve *J* from position *T* to position *P*, and the cutters from position *V* to position *O*, the boring bar returning to the initial starting position. When the cutters are in position *V* they can be adjusted for size.

Taper Attachment for the Turret Lathe

DOUGLAS TURNER

In the taper attachment illustrated the circular plate *A* is pivoted in the center to the under side of plate *B*, which is attached to casting *C*. Bolts passing through holes *D* secure the device to the front toolblock on the cross-slide *F*. The square bar *H* is a sliding fit in the built-up bearing *J* and carries the toolbit *K*. Lever *L* is pivoted to link *M* and is provided for returning the tool to the starting position after the cut has been made. Latch *N* on the shank of the drill holder engages the end of bar *H* and advances the toolbit to the work as the turret moves forward. Circular slots *O* in plate *B* receive studs in plate *A* and permit it and bar *H* to be adjusted for limited variations of taper.

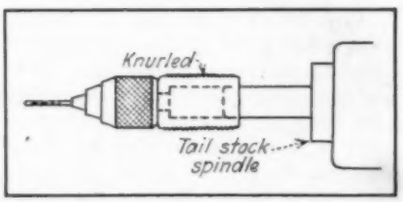
When the device is used in connection with a drilling operation, as shown, latch *N* is disengaged, permitting the drill to act alone. After the work has been drilled, the latch is thrown into engaging position and a second forward movement of the turret is made without indexing it. As the turret moves forward, latch *N* contacts with the end of bar *H*, sliding it along and carrying the toolbit across the work, the drill merely entering the drilled hole. This device has proved to be very convenient for turning short tapers. It can be quickly set up and adjusted to the desired taper. When the cutting-off tool in the rear toolblock is brought forward to cut off the work, the adjustment of the taper attachment is not disturbed.

Sensitive Drill Chuck Holder for the Lathe

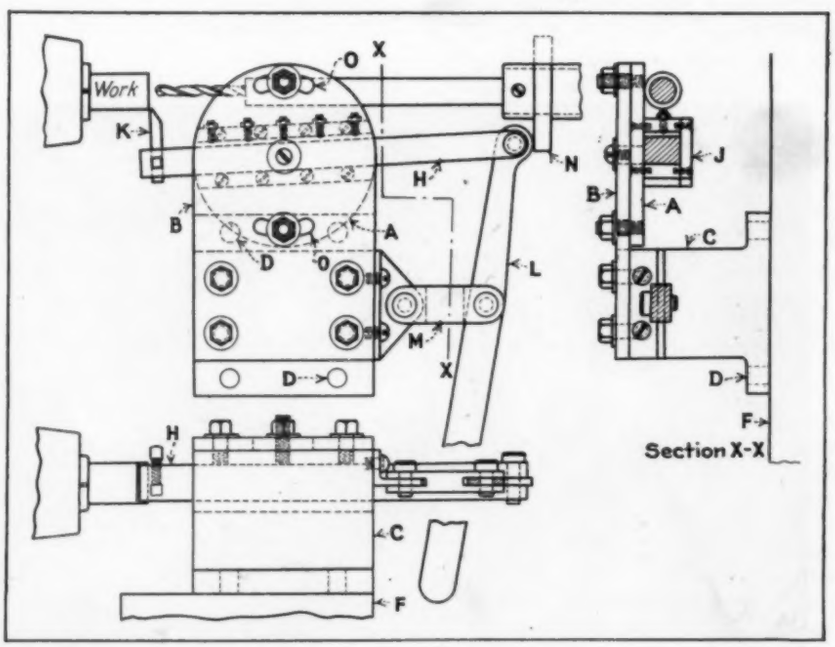
CHARLES HOMEWOOD

In the illustration is shown a sensitive drill chuck holder. It consists simply of a knurled sleeve on which is mounted the drill chuck, and a plug center held in the tailstock spindle.

In operation, the knurled sleeve is grasped by the hand and is slid along the plug center, bringing the drill into contact with the work. Resistance to the turning effect of the drill is governed by the tightness of the grip on



The drill is fed to the work by grasping the knurled sleeve and sliding it on the plug center held in the tailstock spindle



For turning short tapers in the turret lathe, this attachment has proved to be very convenient. It is easily and quickly set up and adjusted

the knurled sleeve. In drilling small, deep holes, the drill can be quickly backed out to clear the chips by simply sliding the knurled sleeve back on the plug center.

Comparing Tapered Threads With an Optical Comparator

A. J. WORMWOOD
Independent Pneumatic Tool Company

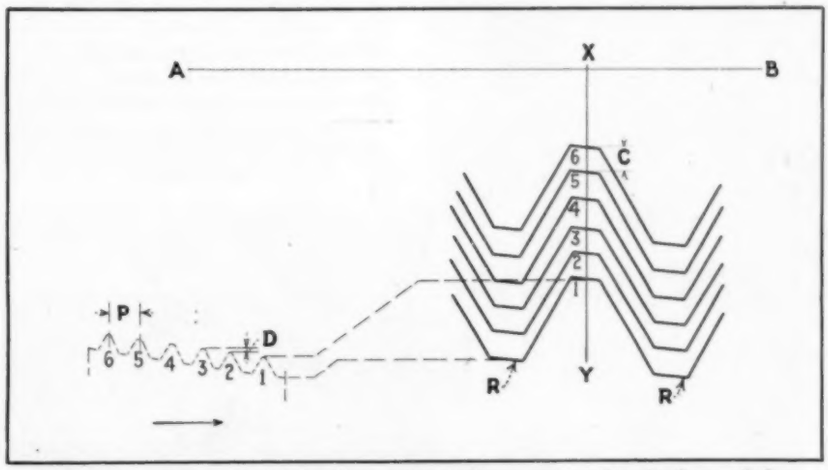
The usual bench-type of optical screw-thread comparator, or projection lantern, is not designed for the inspection of tapered threads, as one thread only can be examined at a time. If a part having a tapered thread is moved axially one thread interval at a time, the successive shadows will not and cannot be made to line up with the single outline on the standard chart.

The illustration shows a chart designed for inspection of gages having tapered threads, which can be mounted on the movable carriage of the comparator. The chart is based on the fact that when the gage is indexed axially from one thread interval to another in the direction of the arrow, the center lines of all shadows will coincide with the vertical line *X-Y*. Furthermore, the spacing from crest to crest of the successive shadows will be equal. Thus instead of a single outline there is a series of outlines, one for each thread interval to be inspected.

The vertical row of truncated triangles at the right represents the boundary lines of these shadows. The dimension *D* from the crest of one thread to the crest of the adjacent thread of the gage is equal to the pitch *P* multiplied by the tangent of one-half the included angle of taper. The spacing *C* on the chart is equal to dimension *D* multiplied by the magnifying power of the comparator. All other dimensions, except the angle for the profile, must be increased in the same proportion.

A master gage, if available, is used for positioning the chart when a screw or a gage is to be inspected. Lacking a master gage, the line *A-B*, at a right angle to line *X-Y*, can be lined up with the shadow of a cylindrical gage, the center line of which must be parallel with the center line of the part to be inspected.

The dotted screw-profile is not a part of the chart, but is shown to illustrate the relation between the threads and the shadows. The lines *R*, representing the extreme depth of thread required, are drawn to the same taper as that of the lines at the crests. Any part of the thread below these lines does not affect the fit of the mating parts and is not considered in the inspection operation. Boundary lines for limits are omitted. If the lines come too close together on the chart, outlines of alternate threads only are drawn on the chart.



The series of truncated triangles at the right represent the shadows of the successive threads of a tapered thread gage, as indicated by the numerals

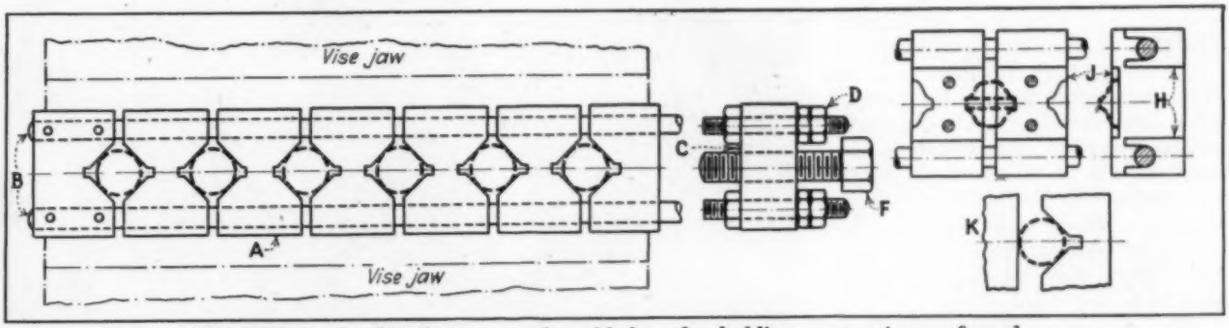
A Flexible Fixture for Gang Milling

JOHN A. HONEGGER

In shops where small-lot milling is done it is of advantage to have the tooling as flexible as is possible, so that but little time is required for changing from one job to another. For such a shop the fixture illustrated was designed.

The fixture is held in the machine vise and consists essentially of a series of V-blocks *A;* the alignment rods *B;* the yoke *C;* the adjusting nuts *D;* and the clamping screw *F*. The V-blocks at the ends are single, but the intermediate ones are double. The alignment rods pass freely through the V-blocks and are pinned to the one at one end. At the other end they are connected by the yoke carrying the clamping screw. To insure that the V-blocks will slide apart when the clamping screw is backed off, flat springs *H* are inserted between them.

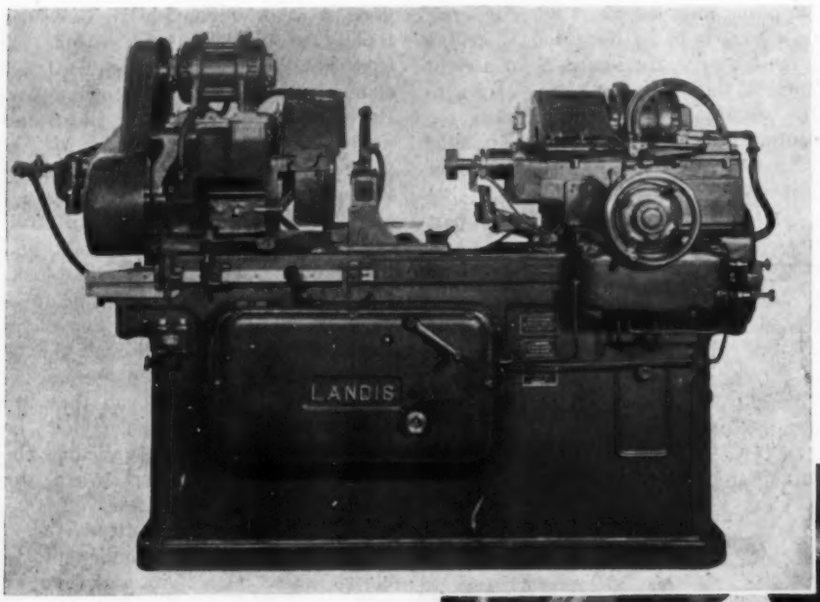
By adding to the number of V-blocks, more pieces of work can be held, the number being limited only by the width of the vise in which the fixture is held. For holding thin, flat pieces, nest plates can be attached to plain blocks, as at *J*. If three-point clamping is desired, blocks of the type shown at *K* can be used.



The V-blocks in this fixture can be added to for holding more pieces of work, the number being limited only by the width of the vise in which the fixture is held

SHOP EQUIPMENT NEWS

Landis 15 In. Type C Hydraulic Internal Grinders



The Type C hydraulic internal grinders, manufactured by the Landis Tool Co., Waynesboro, Pa., may be used for the rapid production grinding of similar parts within a close degree of accuracy. Two sizes are offered. The 15x8 in. size is recommended for the grinding of smaller bores and has as its outstanding features the Landis-Solex sizing device and a hydraulically reciprocated grinding wheel fixture. The 15x11 in. size is for the deeper bores. The former may be furnished without automatic sizing or hydraulically reciprocated grinding wheel fixture, when rapid production grinding does not have to be performed.

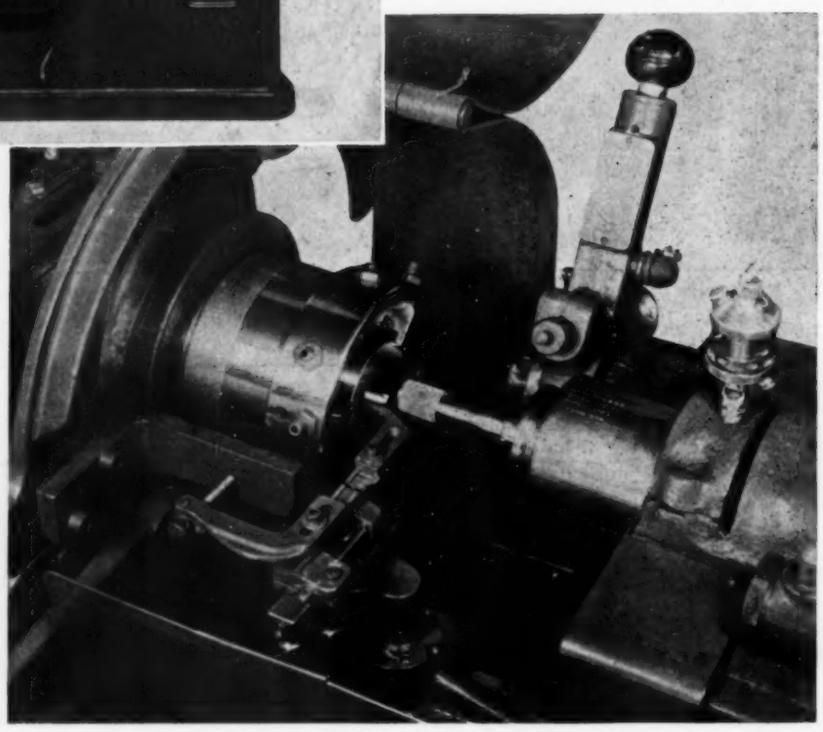
The Landis-Solex sizing device functions directly from the work diameter. Such variables as wheel wear, difference in amount of stock to be removed and spring in the grinding wheel quill do not affect its accuracy. It may be used for any straight or tapered hole. It will size many splined, key-wayed or interrupted holes. Operation of the device is based on the sensitiveness of change in air pressure. This sensitiveness is made to control machine movements by means of mercury-type electric switch and solenoids.

When grinding bores 2¾ in. in depth, or less, the grinding wheel fixture is hydraulically reciprocated. Bores having a depth greater than 2¾ in. are ground by hydraulically reciprocating the work table.

Another feature is the grinding wheel quill spring compensating device. As a result of its use the cross feed automatically compensates for any spring in the grinding wheel quill. Bores having steep tapers with angles up to 90 deg. may be handled on the standard machine. All valves, piping and connections are accessible for inspection. A compact water, oil and air pump mounting is located at the rear of the bed. Operation of the machine is semi-automatic.

The following additional features have been designed into the machine:

Left—Two sizes are offered; the first for work to 2¾ in. in depth, the second for deeper work. Below —The Landis-Solex pneumatic sizing device functions from the work diameter



an Excello ball bearing spindle sturdily supported well out toward the wheel, a grinding wheel feed which operates automatically or manually, wheel base hydraulic back lash and a rigidly webbed bed of box type construction, having the water reservoir integral at the rear and the oil reservoir in its base.

Net weight of the 15x8-in. machine without electrical equipment is 5,500 lb. Net weight of the 15x11-in. machine without electrical equipment is 5,800 lb. Three electric motors are used. The work drive motor is a ¾-hp. constant-speed on the 15x8 in. size and a 1-hp. constant-speed on the 15x11 in. size. Both machines have a 1½ hp. constant-speed pump-drive motor. Either a 3- or 5-hp. constant-speed wheeldrive motor is used on the smaller machine while the larger machine requires a 5-hp. constant-speed motor.

Barber-Colman Taper Spline and Hobbing Machine

The Barber-Colman Co., Rockford, Ill., has developed a taper spline which is adaptable to any machine or mechanism requiring a gear, wheel, pulley, arm or similar unit to be mounted removably on the end of a shaft or axle. This construction, Fig. 1, does not weaken the shaft. Therefore, shaft dimensions may be reduced for a given power-transmission requirement. Other advantages of the taper spline are: greater key contact area, greater stress distribution, keys cannot loosen or be lost and corners of keys will not round off under reciprocating stresses.

The Barber-Colman taper spline hobbing machine, Fig. 2, resembles the company's Type "A" machine. The hob slide swivel construction, Fig. 3, is the main point of difference, as it has means to traverse the hob not only laterally but also longitudinally. The hob has a tapered form. The longest teeth enter the work first and cut the deepest part of the keys. As the hob moves along the shaft, it also moves across it so that progressively shorter teeth cut shallower portions of the spline. A given hob can make a variety of tapers on a given size of shaft, but for a different size shaft a separate hob is required. This machine contains an additional feed screw in the lower hob swivel slide to give the hob its longitudinal traverse. Special micrometer dials on the work slide and main feed screw aid in positioning these members. A single gearbox on the left end of the machine contains all the change-gear trains. The machine is powered with an electric motor mounted in the base. Automatic stops and safety stops are provided on the two traversing slides. A quick-action tailstock helps to speed up loading and unloading. Centralized pressure lubrication is supplied. Bedways are protected by heavy telescoping guard plates. Coolant is strained of chips and circulated through reservoirs.

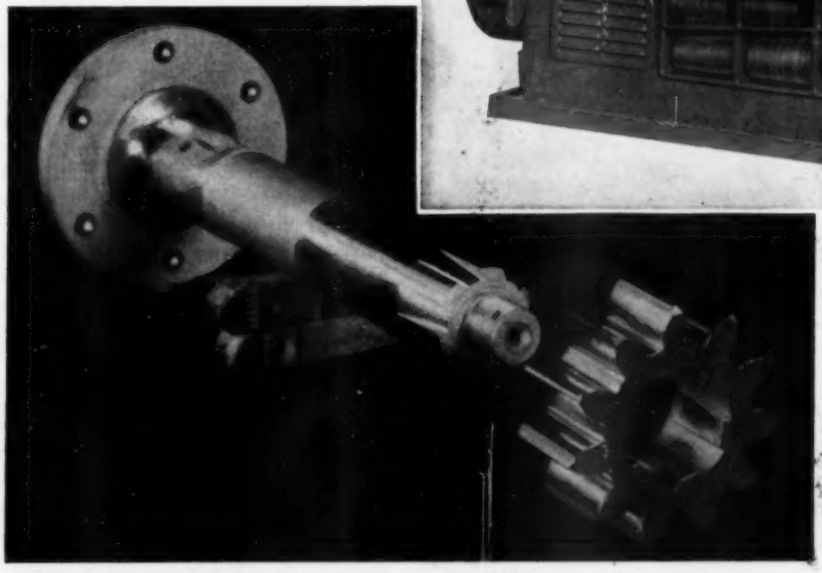


Fig. 1—The hub is bored with a taper hole, and broaching with a standard broach forms the grooves for the keys

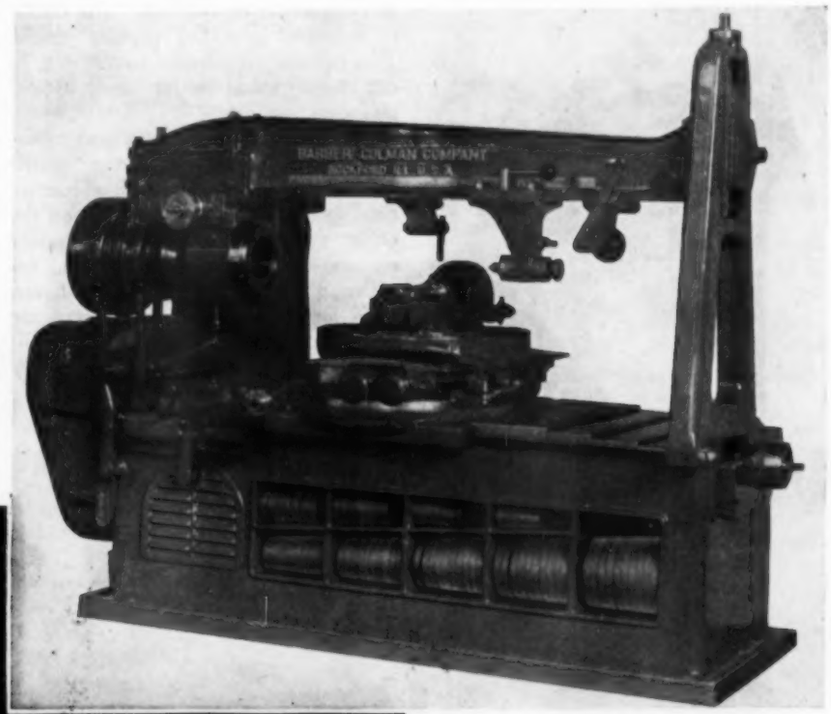


Fig. 2—Barber-Colman Hobbing Machine for producing the taper spline can be used for all standard hobbing operations

"Toolweld" Electrode

An arc-welding electrode, known as "Toolweld," which is designed for restoring worn edges on tools, is announced by the Lincoln Electric Co., Cleveland, Ohio. "Toolweld" electrode provides a deposit which is equivalent to high-speed tool steel and will retain a hardness of 55 to 65 Rockwell

C up to approximately 1,000 deg. Fahr. The hardness is increased by allowing the deposit to cool slowly and by depositing additional beads. The electrode is covered with a coating which, as it is consumed in the arc, shields it from the atmosphere and prevents the formation of oxides and nitrides in the weld metal. Toolweld electrode is made in 14 in. lengths in four sizes, 3/32, 1/8, 5/32 and 7/32 in.

Covel Universal Angle Vise

The universal angle vise, being introduced by the Covel Mfg. Co., Benton Harbor, Mich., is offered for use when grinding, milling and drilling at any angle. The work is held by a fulcrum clamp, and the angle adjustments are locked by hardened nuts. The vise can be used on a surface grinder, milling machine, drill press, or shaper with normal cuts without slipping the work or adjustments. Two models are available, Style A having a capacity of 1¼ in. and Style B a capacity of 2½ in. Specifications: Style A, base dimension, 4½x3 in.; width of jaws, 2¾ in.; weight, 7 lb.; Style B, base dimensions, 8⅞x4¼ in.; width of jaw, 4 in.; weight, 20 lb.

Gleason No. 15 Spiral Bevel Pinion Rougher

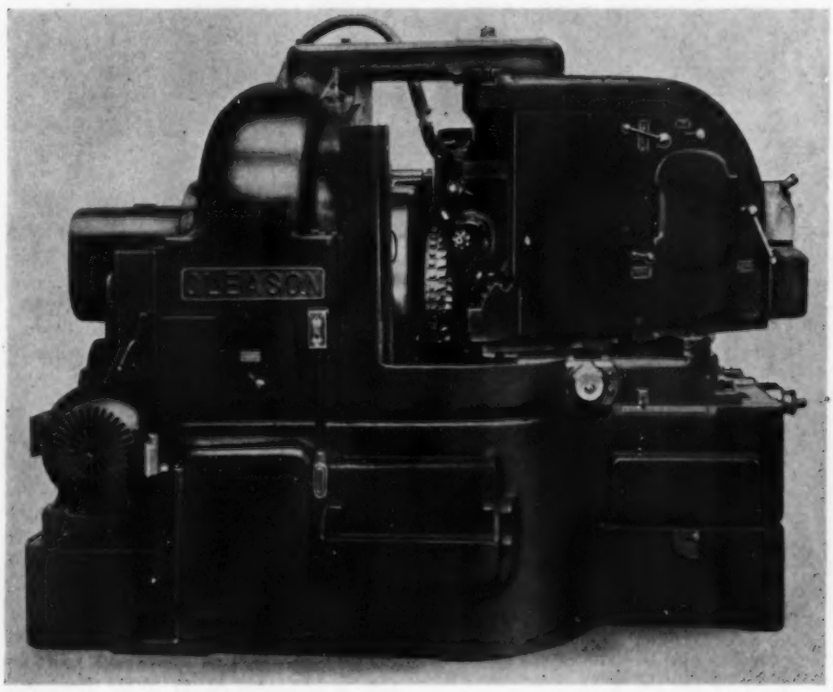
The Gleason Works, Rochester, N. Y., has designed and built a spiral bevel pinion rougher which is said to be from two to three times as fast in production as the older type of machine. The machine will rough both spiral bevel and hypoid pinions. It is hydraulic in all of its movements except the drive to the cutter. Clamping of the pinion in the chuck is also accomplished hydraulically. A built-in dechucking device releases the pinion at completion of the cut. The cutter is mounted in a full circular cradle. This permits adjustment to 360 deg. to cut both spiral bevel and hypoid pinions.

The machine comprises a heavy one-piece frame with the cutter cradle mounted on one side, and a column holding the work-head mounted on the other side. An overhead tie rigidly secures the cradle and column together. The cutter spindle is driven by a large internal gear. A separate motor drives the spindle. This simplifies the drive so that there are only three gear meshes between the motor and the cutter spindle, including speed change gears. The circular movement of the cradle and work spindle for generating the tooth shape are derived from a reciprocating movement of a pair of racks which are connected and actuated by hydraulically operated roll piston. Short trains of gearing transmit the motion of these racks to the cradle and to the work-spindle. A hydraulic brake is provided to take up backlash in the generating train. Pinions of different ratios can be cut by changing the ratio of roll gears in the train to the work-spindle.

The work-holding spindle is sufficiently large in diameter to accommodate taper bores up to 3.906 in. The index is of the notched-plate type. In and out feed of the work-head permits periodic indexing and the withdrawal movement for dechucking is effected hydraulically. Completion of one of these movements trips the other. The rapid return of the feed is at constant speed regardless of the feed rate.

The machine is arranged so that as the last tooth is cut the work-head is withdrawn automatically at full speed to the chucking position. A single lever is used to dechuck the work. A power-stripper mechanism is also provided to adjust the cutter pinion so that it is loosened ready for removal. The coolant pump and the hydraulic pump are driven by one motor which is separate from the cutter motor. The pump motor runs at 1,200 r.p.m., and the cutter motor runs at 1,800 r.p.m. Lubrication of the machine is entirely automatic. The machine is interlocked so that the feed will not start unless the cutter is running and the work chucked. Net weight is approximately 15,400 lb.

Specifications: longest cone distance, 30 deg.; spiral angle, 7⅝ in.; largest pitch angle, 26 deg. 34 min.; smallest pitch angle, 7 deg. 7 min.; extreme ratio, shafts at 90 deg., 8 to 1; largest pitch diameter, 8 to 1 ratio, 1⅞ in.; largest pitch diameter, 2 to 1 ratio, 7 in.; largest pitch, Gleason system, 2½ D.P.; maximum full depth, ¾ in.; longest face, 1¾ in.

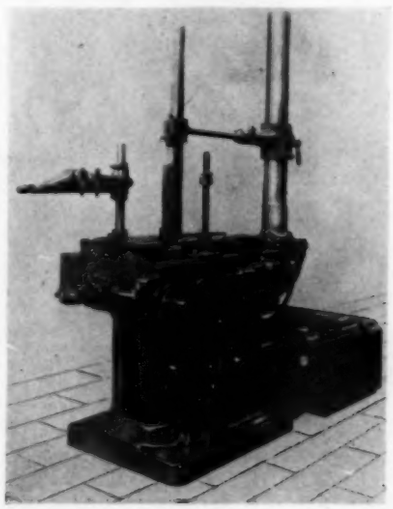


Morton Stationary Keyway Cutter and Slotter

A keyway cutter and slotting machine, developed by the Morton Manufacturing Co., Muskegon Heights, Mich., is so designed that the work remains stationary at all times. The correct adjustment for taper, depth of cut and cutting of keyways in taper bores comes in the guides, crosshead and cutter bar member. The top plate is T-slotted on the top surface to facilitate the use of binding bolts. An auxiliary top plate is used between the main top plate and the work, as a protection in the handling of heavy work. The auxiliary top plate contains the centering jaws for centering all diameters of bores. A bracket is bolted to the front of the top plate which contains a rotating nut and screw mechanism for feed. A locking collar graduated in thousandths provides a means for setting to total depth of cut. A ratchet feed mechanism is provided with feeds ranging from 0.001 to 0.020 in. per stroke. It is so arranged that when the cutter reaches a predetermined depth a friction slips, limiting the depth and making practical duplication of depth without resetting.

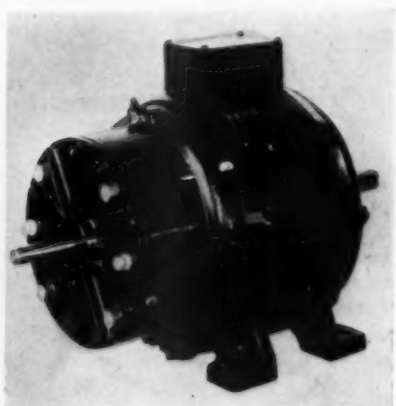
The guide contains all the gearing for transmitting the power to the spiral cut pinion and rack which reciprocates the crosshead and the cutter bars. This guide is journaled in a special trunnion member. The trunnion member has bearing surfaces which move in line parallel with the top surface of the top plate. A positive means is provided for locking the guide with the trunnion member, so that the guide, crosshead and bar may be thus adjusted to any angular position with respect to the top plate up to 1 in. taper per ft.

The driving unit consists of a gearbox in which two clutches run in oil in opposite directions. Reciprocation is obtained by means of engaging one or the other of these clutches. This motion is transmitted to the guide by means of a universal-joint spline shaft. Power is supplied to the gearbox by either a constant-speed d.c. or a.c. motor, a variable speed d.c. or a multi-speed a.c. motor driving through multiple V-type belts. Cutter bars are made of a rectangular-section heat-treated steel forging. Tool slots for inserted-type, high-speed steel cutters are accurately finished and the pressure surfaces are lined with removable hardened liners. This machine can be furnished in sizes ranging from 30 to 60 in. cutting stroke.



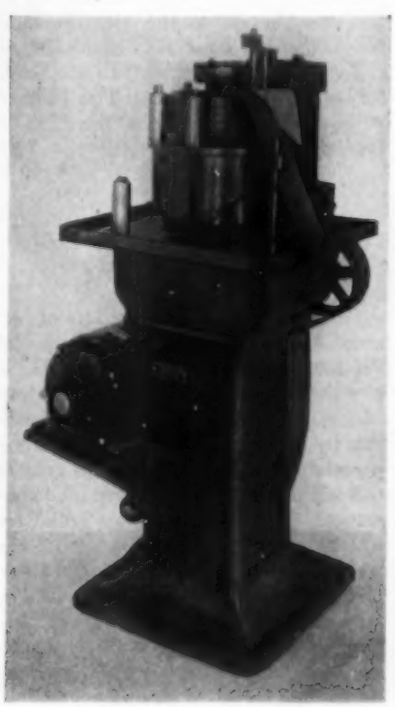
"Electric Specialty" Motor with Magnetic Brake

The Electric Specialty Co., Stamford, Conn., has announced motors with brakes for use on applications where the load must be held whenever power is shut off. When no electrical power is applied to the motor terminals, calibrated springs press the stationary and rotating disks together. Brake linings are mounted on the rotating disks which are secured to the motor shaft. As soon as electrical power is applied to the motor, electromagnets counteract the action of the springs and release the braking pressure on the disks. The entire brake is built integral with the motor to form a compact unit. The electro-magnet windings are connected to the motor supply leads inside the motor, thus simplifying installation. The tension of the springs which govern the braking torque may be altered to take care of a wide variety of operating conditions. These brakes are furnished built into a.c. and d.c. motors of single, multiple and variable speeds.



Noble & Westbrook Tube Marking Machine

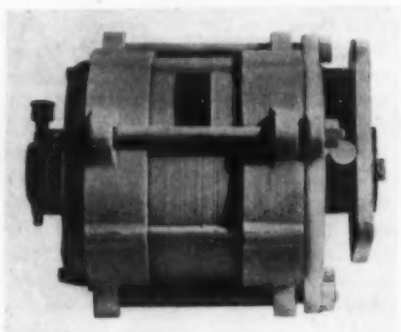
The Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn., has placed on the market a heavy-duty, production marking machine, for marking an inscription consisting of approximately 200 letters and figures, on thin tubes up to 4 in. long and 1¼ in. diameter. A carrying dial is provided having six stations consisting of hard steel mandrels to support the shells. The pressure dial, working above the carrying dial, gives uniform pressure as the tubes pass between the marking dies and the pressure roll. To provide extra strength and rigid construction, the central shaft is secured to the die holder and the top of the machine by an arm, rotating in a roller bearing. Unloading pins, operated by cams, raise the tubes after the inscription is rolled on, and they are unloaded automatically. The pressure dial and carrying dial are designed so that they will operate at uniform



speed during the marking operation or when running idle. This is accomplished by inclosed spur gears. To prevent the possibility of the machine getting jammed by improper loading, the carrying dial is carried on a friction cone which will allow the machine to run without damage if a part should not feed accurately. The machine is driven by a ¾-hp. motor through worm and gear. Production is 60 tubes per minute. Weight is approximately 450 lb.

"Electric Specialty" Torque Motors

Torque motors for special requirements have been developed by the Electric Specialty Co., Stamford, Conn. Units have been designed for controlling valves, for operating watertight doors, for elevator door operation and many other applications. The



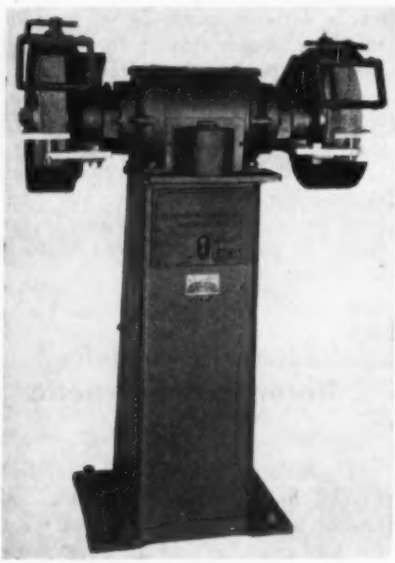
mechanical design must be adapted to the construction of the machine, and torque motors must be designed especially for the requirements in each case for satisfactory results. The electric valve-control motor illustrated is a typical torque-motor design.

Sauer-Eisen No. 21 Acid-Proof Cement

Sauer-Eisen No. 21 acid-proof cement, manufactured by Technical Products Company, Pittsburgh, Pa., is a white powder of high silica content which, after mixing with water, hardens by chemical action into a strong porcelain-like structure. This cement will adhere to practically any solid substance. The cement has an initial set which is rapid enough to permit the laying of bricks continuously. Complete set occurs in 24 to 36 hours. The cement will stand over 2,000 F., and may be used as a mortar in conjunction with acid-proof bricks in pickling tanks.

Production Type 896 Grinder

This Type 896 grinder is a development of the Production Equipment Co., 5219 Windsor Ave., Cleveland, Ohio. The brackets are designed for use with three different lengths of extension housings, the shortest for two-bearing machines, the medium and the longest for four-bearing designs. The distance between wheels for the various machines range from 21 to 42 in., allowing ready adjustment to individual operating requirements. The guards are adjustable to both wheel wear and lo-



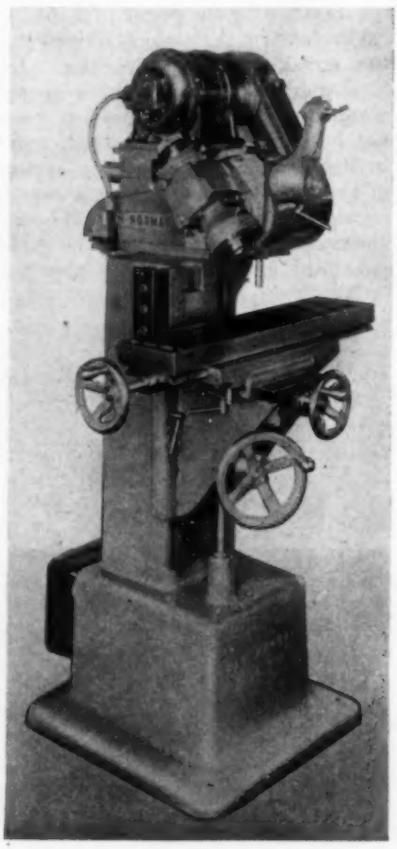
cation of guard openings. This construction permits the adjustment of the guard close to the wheel, regardless of wheel diameter and also allows the guard to be rotated for any desired grinding position. Standard grinders are furnished with alloy steel spindles, large sized ball bearings, oil lubrication, safety type steel guards, automatic starters and combination tool tray and water pot. Ratings are from 1 to 3 hp. for use with 8-, 10- and 12-in. wheels.

"Dialux" Luminescent Paint

"Dialux" luminescent paint, the principal element of which is "sulphur of calcium," a phosphorescent salt, is being placed on the market by the Grobet File Corporation of America, 3 Park Place, New York, N. Y. Sulphur of calcium has the quality of glowing in the dark after having been exposed to light. The luminosity lasts for 12 hours. The luminescence of painted articles can be restored by repeating the exposure to light. Dialux does not contain any radio-active matter, and is not inflammable nor toxic. It can be obtained for brush application or for use in an air gun. This paint can be used to indicate fire extinguishers, parts of machinery, hydrants, projecting beams and staircases.

Van Norman No. 6 Milling Machine

This No. 6 miller, manufactured by the Van Norman Machine Tool Company, Springfield, Mass., differs from the other machines in the line chiefly in its smaller size and in the fact that it is built with hand feeds only. It is designed to handle the wide range of operations occurring in pattern and experimental shops and toolrooms. The cutter head may be swiveled to mill vertically, horizontally, or at any angle. Combined adjustment of the cutter head and the ram make it possible to mill any angle throughout the full run of the table with a standard milling cutter. Sliding gears and 3-step pulleys controlled by quick-change shifting levers provide for nine speeds, ranging from 80 to 1,450 r.p.m. The knee is of box-type construction.



Niagara No. A-5 Press

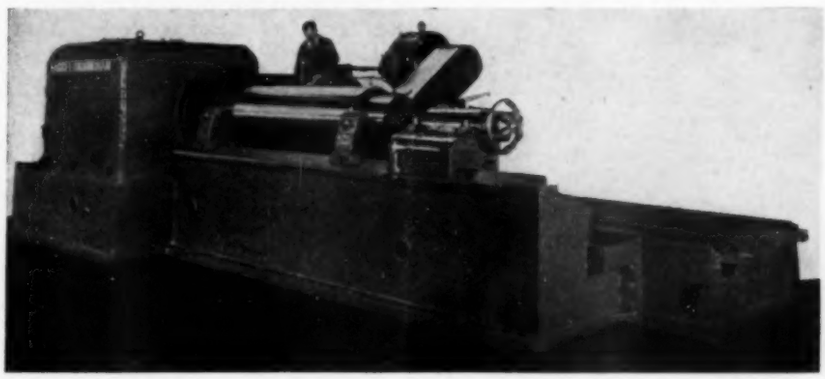
The Niagara Machine Tool Works, Buffalo, N. Y., has brought out an improved 5 in. diameter shaft press, known as the No. A-5. It is equipped with a six-point engagement pin clutch, providing more prompt engagement, more strokes per minute and safer operation. A safety stop is provided to prevent repeating through overtravel of the shaft, and a device locks the clutch pin out of engagement when setting dies. The engagement wheel facing is removable by removing six free fitting through bolts so designed that four of them act as forward drivers and two of them as backward drivers. Renewal of wheel face renews all working surfaces. The clutch pin and spring can be inspected or replaced without removing the wheel from the shaft. The brake is equipped with a spring that automatically compensates for expansion due to heat of operation, as well as compensating for wear.

A "Breech Block" type of die clamp is used. This die clamp is cylindrical in shape and fits in a smooth bored hole, the center of which is sufficiently above the bottom of the slide to prevent it from sagging. Triple V gibs are used and the gib bolts are placed close

to the slide, thus receiving their load directly and not through an unfavorable leverage. The large diameter backshaft, with its bearings, is mounted in a heavy tubular casing. This assembly is held in position in the press by entering it into two holes, bored in the frame at the same setting that was used when the main bearings were bored, thus assuring alignment. The press can be inclined by one man without the aid of a crane or helper.

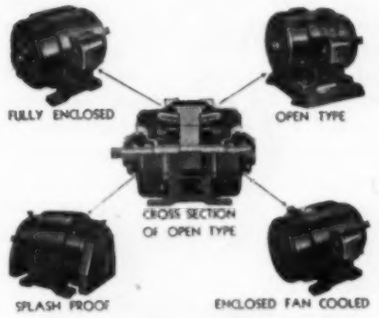
Farrel-Birmingham Roll Grinder

An improved design of heavy-duty roll grinder has been announced by the Farrel-Birmingham Co., Ansonia, Conn. The headstock drive on this 36-in. machine is self-contained in a cast-iron case, mounted on the front bed. Three reductions, all of which are multiple V-belt drives, reduce the speed of the 800- to 1200-r.p.m. motor to give a range of roll speeds from 11 to 44 r.p.m. V-belt drive is used to eliminate vibration in the headstock. The three reductions can be adjusted separately to give the proper tension on the belt without the use of idler pulleys. An improved, flexible faceplate, with balanced, self-equalizing bar equipped with adjustable rubber-bushed driving dogs, compensates for inequalities in roll wabblers and automatically minimizes inaccuracies due to minor errors in setting the roll. The diameter of the grinding wheel has been increased from 30 to 36 in. so that at the same wheel surface speeds, the speed of the spindle is reduced, permitting a closer fit of the bearings. Other features incorporated in this machine are: the cambering device, dead-center head and foot stock, water-shedding front bed, centralized controls and double helical gear to worm and rack traverse drive.



Harnischfeger Convertible A.C. Motors

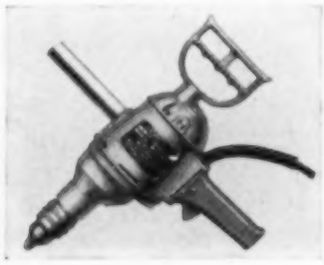
A line of convertible squirrel-cage and split-ring induction motors, offering all standard frequencies for service ranging from 110 to 220 volts, has been announced by the Harnischfeger Corp., West National Avenue, Milwaukee, Wis. The feature of these two



motors is their ready convertibility from open type to fan cooled, splash-proof or totally inclosed construction. This is accomplished through the design of the frame, end heads and bearings to permit interchangeability of the four types. Another feature is the mounting of the stator laminations which are stacked between heavy steel end rings and the entire assembly then welded to the frame. This construction provides rigidity, and makes it impossible for the stator core to shake loose. Ratings range from ½ hp., 600 r.p.m. to 125 hp., 3600 r.p.m.

Signal Type OB-5 Portable Drill

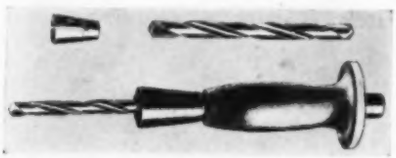
A ½-in. portable electric drill, known as Type OB-5, has been announced by the Signal Electric Mfg. Co., Menominee, Mich. It has the breastplate



type handle, with detachable pipe handle. The switch is of the trigger type with lock for continuous operation. Standard equipment includes 12 ft. of heavy duty, rubber-covered cord with a rubber plug. Aluminum alloy is used for the housing. The motor is a Signal universal for 110-120 volts. It delivers 420 r.p.m. at no load. Overall length is 16½ in., net weight, 14 lb.

Double-Ended Hammer Drills

Double-ended hammer drills have been placed on the market by the Brush Nail Expansion Bolt Co., Greenwich, Conn. The drills comprise "Double Enders," drills pointed at both ends, a holder and a collet for each diameter drill. Various sizes of collets fit the same holder. Electric hammer drill chucks are furnished to adapt double enders to all power hammers.



Thomson-Gibb Seam Welder

The resistance welder illustrated was designed by the Thomson-Gibb Electric Welding Co., Lynn, Mass., to simplify the welding together of extremely wide sheets of metal. This wide sheet seam welder employs two traveling welding rolls which provide the contact above and below the seam. The problem of connecting the traveling rolls to the transformer was overcome by making them an extension of the transformer secondary. When the machine is in operation, the entire unit consisting of the transformer secondary and welding wheel travels the length of the seam propelled by hydraulic means.

"Pony" Miniature C-Clamp

The Adjustable Clamp Co., 417 North Ashland Ave., Chicago, Ill., announces a line of "Pony" miniature C-clamps. These clamps have a 1 in. depth of throat and openings of 1 and 2 in. Frames are made of malleable iron, and the foot is smoothly ground and cadmium plated. The steel screws have standard threads and are tipped with freely turning swivels. The loose-pin handle gives ample pressure without resorting to pliers, and yet permits operation in close quarters.

• TRADE • PUBLICATIONS

Adher-O-Scope. Sperry Products, Inc., Manhattan Bridge Plaza, Brooklyn, N. Y., has issued Bulletin No. 73. It contains graphs and explanation of the correlation between service performance, laboratory tests and the Sperry-Cammen Adher-O-Scope for testing lubricants.

Boring and Drilling Machine. Joseph T. Ryerson & Son., Inc., Chicago, Ill., have issued a folder with specifications, outlining fully the versatility of their line of horizontal drilling, boring and tapping machines.

Compressors. In Bulletin 728 (First Edition) the Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y., describes its horizontal single-stage compressors, Type T. Complete details, including cross-sectional views and a table of sizes and ratings, are given.

Fiber Sheets. The Spaulding Fibre Co., Inc., Tonawanda, N. Y., has published a folder presenting engineering data on Spauldite sheet from which a variety of electrical and mechanical parts are made.

Fiber Tubes. A folder issued by the Spaulding Fibre Co., 484 Broome St., New York, N. Y., is devoted to descriptive matter and engineering data on fiber tubes.

Furnaces. The Hevi Duty Electric Co., Milwaukee, Wis., illustrates and describes its line of electric heat-treating furnaces in Bulletin HD-135. A table of specifications lists 21 types.

Gages. In an 11-page booklet put out by the Langlois Grinding Co., Inc., 1602 Twenty-third St., Detroit, Mich., the company presents its line of "Gage-Matic" gages. Drawings and tables giving dimensions and specifications are included. Tips and other contact points of these gages can be tipped with tungsten carbide to insure wear resistance.

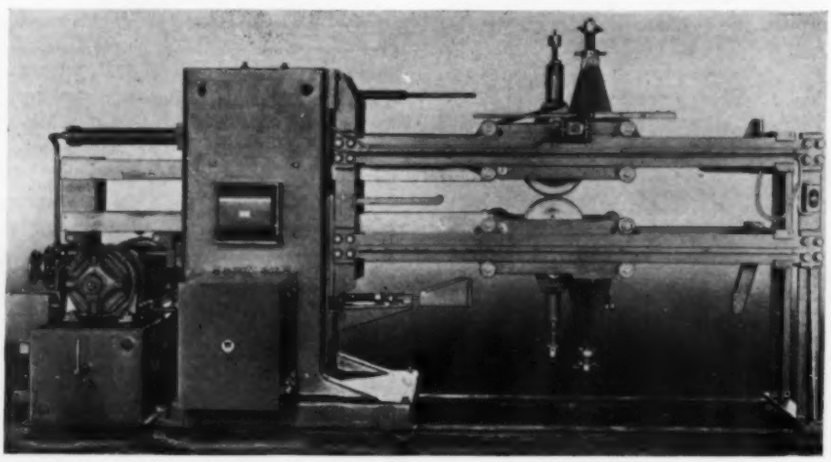
Platforms, Truck. Bulletin 252, published by Barrett Cravens Co., Chicago, Ill., sets forth "Eight Added Values in Barrett Steeleg Platforms." Illustrations show details of construction. Various other Barrett products are illustrated.

Rubber Goods. A book containing 21 pages of engineering data and describing over 200 industrial rubber items has been compiled by the B. F. Goodrich Co., Akron, Ohio. A review of belting requisites for a wide variety of uses is included.

Shafting. The Bliss & Laughlin Co., Inc., Harvey, Ill., has issued a folder describing its line of steel shafting. A table giving shaft diameters, carbon content and tolerances is included.

Stainless Steels. Booklet No. 125-A, put out by the Republic Steel Corp., Massillon, Ohio, contains data on the various members of the Enduro 18-8 family of stainless steels. The booklet is well illustrated. A table is given showing the degree of corrosion resistance of Enduro in the presence of several hundred reagents.

Washers and Stampings. A handbook, published by the Wrought Washer Mfg. Co., Milwaukee, Wis., entitled "Special Washers and Stampings," lists over 19,000 tool-sets for producing washers and stampings. This publication provides a source of reference for the selection of assembly parts and special units.



THE ROUND TABLE

Hiring Older Men

"Glad to see you're hiring more men, Al. But why the old-timers I see out in the shop? Don't you know this is the age of younger men?"

"I know there's been a lot of hot air spilled along those lines for a long time, Ed. Most of it is bunk, according to my notion."

"You don't think a man of forty-five is as spry as one of twenty-five, do you?"

"Probably not, Ed. But we aren't training acrobats, nor running marathons. We're building pumps—and darned good ones, if I do say it. Spryness counts for very little in our work. What I want is accuracy and stick-to-itiveness."

"But you don't think an older man is more accurate, do you?"

"Depends on the man, Ed. Accuracy grows with experience if the man has it in him. And a good man of forty-five, or even fifty-five, is apt to be fully as accurate as the younger man."

"But can't the younger man turn out more work? Or do you get these men for less money?"

"No, to both questions, Ed. If the men had to 'horse' the pump bodies around, or do other laborious work, you might be right. But they don't. We lift them by power. And when it comes to getting them set up and the machine started, the older men usually come out ahead. More experience has taught them a lot of short cuts that help."

"Don't they lay off more on account of illness or in bad weather?"

"You make me laugh, Ed. You know darned well your Dad never stays in on account of weather, and I'll bet you pay the doctor more than he does every year. And your Dad is older than any of these new men."

"But I like to see men of that age take it easier than working all day."

"I don't suppose they would object to retiring any day, Ed. But until we get the Townsend Plan working they have to earn a living, and we're getting the benefit of their years of experience. You spoke of paying them less. We ought to pay more if anything. For they have helped us out of more than one jam by utilizing some of their past experience—stunts that the younger men never even heard of."

"What about this stick-to-itiveness as you call it, Al?"

"Simple enough. Age settles most of us to some extent. Men of fifty are not as apt to bury a grandmother when there's a ball game. They usually take more interest in their work and are not as likely to be hunting a new job."

What are the comparative merits of 25- and 50-year old men in the average shop? Who loses most by discrimination against the man over 45?

Discussion

Codified Skill

The skilled worker, truly a craftsman, is a capitalist who puts his capital to work and uses his knowledge and skill to the greatest mutual advantage of himself and his employer. To attempt to codify skilled workers is as impracticable as it would be to guarantee a fixed profit on all types of investments. There is an intangible something in many workers that employers sense and are quick to put to work for their advantage. Then why is it not logical to pay extra-good men more than the men who say they can do the same quality of work, but who never measure up to what they lead us to expect from them?

Even Soviet Russia's dictators have recently admitted that the profit motive is necessary for any success they may hope to have in getting the workers enthusiastic in taking hold of their problems, not the least of which is to prevent starvation among unskilled but loyal workers. Profit motive is just what we pay something extra for to that selected group of skilled workers and is one of the main urges for industry to improve and go ahead. By all means let those extra-value skilled workers have a hand in setting their rate of pay by demonstrating to management just what they are worth on the job. —E. E. GAGNON.

Finish Cuts Only

As to whether or not it is feasible to have separate boring mills for roughing and finishing depends upon the nature of the work. If, after careful study, the figures indicate that the profit on the investment justifies the use of the two machines, then it might be logical to use them. If, however, the only reason for using the two machines is to save one of them from wearing out, it seems to me that the reasoning is wrong. The age of the machine is what makes it obsolete; not how much it is used.

Assuming that the castings to be machined are complicated in shape and could be easily distorted by careless

setting up. Such conditions would naturally mean that considerable time would be used in setting up the job properly. If after the roughing cut has been taken and the job has to be set up on another machine for finishing, I believe the operator would run up against a peck of trouble. It seems to me that it would be more practicable to change cutting tools, having one for roughing and the other for finishing, rather than to disturb the work. If the machine is in good condition, accurate results could be obtained by completing the machining at one set-up.

—Peter L. Budwitz

There is very evidently a great difference in conditions affecting this question. One factor which has a powerful bearing on the problem is the nature of the work involved and to the quantity of work of a given kind. It is plain that if job or detail work is being considered, the proposition of one boring mill for roughing cuts and another for finishing is all wrong, since it would unduly increase the set-up time. Where the machines can be set together with proper locating devices in interrelation, for machining sizable runs of material all alike, then Al's idea begins to take on a practical slant, and it is evident that the larger the lot sizes may be, the more practical is the method.

Another factor has to do with the handling of the material. Not only can both roughing and finish cuts be taken on the same mill, but there are grinding arbors that can also be applied to the boring mill, and time is obviously saved by not shifting the work, particularly on small lots. This point should always be considered.

Still a third factor has to do with machine location and material handling if and when it has been definitely decided to use the method proposed by Al. The ideal layout pre-supposes the machines to be so located that work can be handled from machine to machine, rather than from machine to floor to machine, or from machine to truck to machine. —John E. Hyler.

America's BLUE CHIP Concerns are OAKITE customers!
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*5 of the 6 manufacturers of typewriters rated AAAA in Thomas' Register use Oakite Materials.
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SPECIALIZED INDUSTRIAL CLEANING MATERIALS & METHODS

Trade Schools

Unquestionably, trade schools can give equally as good a preliminary training as the majority of machine shops. In very few instances can it safely be said that shop foremen have ample time adequately to train and educate boys under their charge without neglecting the more important duties of foremanship. Boys require careful and individual treatment and it is a pity that foremen of large machine shops have not more time for their instruction.

In the days of the old apprenticeship system, the machine-shop boy was first and foremost a learner. He was valued by his employer, not for what he was doing, but for what he was being taught to do. Modern industry, making real apprenticeship obsolete, has reversed this conception of the workshop-boy. He is seldom trained; he is exploited. He is not a pupil; he is a wage earner.

In a railroad shop where the writer was employed as a foreman, it was the company's custom to select a dozen of its most progressive boys each year and send them for a part-time course to the local trade school. Needless to say, a large percentage of the boys profited greatly. —A. Eyles,

St. Albans, Hertfordshire, England